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Fábio Tadeu Lazzerini

MINERAL WATERS AND HOT SPRINGS FROM BRAZIL:
Natural Biologically Active Compounds (BAC)

FONTES HIDROMINERAIS DO BRASIL:
Componentes Biologicamente Ativos (BAC) Naturais

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Biologically Active Compounds (BAC) Natural From

BRAZILIAN MINERAL WATERS AND HOT SPRINGS

By Fábio Tadeu Lazzerini

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Examining commission:

____

Supervisor - Prof. Dr. Daniel Marcos Bonotto (IG-UNESP-RIO CLARO)

____

Profa. Dra. Dejanira Franceschi de Angelis (IB-UNESP-RIO CLARO)

____

Prof. Dr. Jairo Roberto Jiménez Rueda (IG-UNESP-RIO CLARO)

____

Prof. Dr. Jorge Luis Nepomuceno de Lima (UNIVERSIDADE FEDERAL DE RONDÔNIA)

____

Prof. Dr. Daniel Figueira de Barros (CENTRO SALESIANO DE SÃO PAULO-AMERICANA)

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ABSTRACT

The natural surrounds and resources wrapping hot or mineral springs belong to sustainable matter involving governance and strategic planning of public health, environment, welfare, tourism and mining sectors. Noted it, through the current Brazilian policy demand: social thermalism/hydrotherapy/crenotherapy selected like complementary alternative medicine (CAM) by health ministry law MS 971/2006 (PNPIC), hydro-thermal therapy qualifying DNPM (MME Ordinance 127/2011 and MME 337/2002), health and wellness tourism formally oriented by tourism ministry and environmental management groundwater resources (Resolution MME / CONAMA 396/2008 and MME / CNRH 107/2010). Whereas as fresh potable reserves or potential mineral aquatic strategic deposits, the main biologically active components (BAC) were identified, with their minimum levels needed to related health benefits. Similar to conventional mining prospection, these "cut off grade" detection, at natural occurrences from Brazil, was the major goal in this work. The bibliographic systematic review allowed identify the main bioactive substances (BAC) related to springs sources of elements enougth or proven as health beneficial and at which indications. Wards after, it was performed a georeferenced database with these same variables (BAC) from Brazilian springs. Overlays all through thematic maps assisted in geographical and geological evaluations, whereas, at the end, statistical comparisons filtered target selection at all. The total 60 possible natural BAC and its minimum values for efficacy globally reviewed and established were detected at least one BAC occurrence from 703 mineral springs at 525 Brazilian cities. The arguments utilized were important in demonstrating the abundant and diverse existence of this endowment, where its potential health applications are virtually unknown today.

Keywords: **therapeutic natural resource, mineral water, hot spring, SPA, BAC ("biologically active compound/component"), balneotherapy, hydrotherapy, health resort, thermalism.**

RESUMO

Os ambientes e recursos naturais de fontes hidrominerais fazem parte da governança e planejamento estratégico na saúde pública, meio ambiente, bem estar, turismo e mineração, sendo a atual demanda política nacional observada em: termalismo social/crenoterapia em medicina complementar (CAM) através da Portaria MS 971/2006 (PNPIC), hidro-balneoterapia classificatória DNPM (Portaria MME 127/2011 e MME 337/2002), turismo de saúde e bem estar orientado formalmente pelo ministério do turismo e gestão ambiental de recursos hídricos subterrâneos (Resolução MME/CONAMA 396/2008 e MME/CNRH 107/2010). Considerando as fontes hidrominerais como jazidas, para sua prospecção foram identificados os principais componentes biologicamente ativos ("Biologically Active Components" ou BAC), com seus teores mínimos necessários e em quais tipos de benefícios à saúde. Encontrar tais ocorrências naturais no Brasil foi a principal meta deste trabalho. Por intermédio de compilação bibliográfica foram identificados os principais bioativos (BAC) relacionados às fontes hidrominerais, seus valores mínimos considerados ou comprovados como benéficos e para quais indicações de saúde. Depois foi confeccionado banco de dados georreferenciado das ocorrências Brasileiras contendo informações para os mesmos BAC. Sobreposições de mapas temáticos auxiliaram em avaliações geográficas e geológicas e, finalmente, comparações estatísticas filtraram a seleção de alvos. Com 60 possíveis BAC e seus valores mínimos para eficácia estabelecidos internacionalmente, em 703 fontes hidrominerais de 525 municípios do país, foi identificada ao menos uma ocorrência desta dotação natural (BAC). Os argumentos utilizados foram importantes na demonstração da existência abundante e diversificada destes tipos de jazidas no Brasil, onde suas potenciais aplicações são praticamente desconhecidas na atualidade.

***Palavras-chave*: recurso natural terapêutico, água mineral, fonte termal, SPA, crenologia, estância hidromineral, turismo de saúde, termalismo, balneoterapia, componente bioativo, ensaio clínico.**

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CHAPTER 1
MINERAL WATER, HOT SPRING AND SPA THERAPY

1.1. Introduction

By recent observations in young star " TW Hydrae," observed a ring aqueous major, may indicate that the water has been aggregated to the Earth since the early stages of accretion, when dust grains and raw frozen were impacting the Solar Nebula, little by little, concentrating a large amount of ice to then form the large oceanic reservoir (Javoy, 2005; Gizis and Riaz, 2008).

The particular atmosphere of hydrogen bonding in water provides unique properties and anomalous compared to other natural materials on the planet. As gas is one of the lighter molecules, as fluid is much denser than expected and how solid is much lighter than normally compared to its liquid form (DeMeo, 2011). The water molecule is smaller, less bulky and lighter than most other natural molecules, therefore, the solid and liquid states have a higher power density and cohesiveness (Durbin, 2012).

The *waters* will be quoted preferably in the plural, because the great diversity in their shapes and compositions of occurrences in nature. Such hydrodiversity (GLOSSARY) is a term that has been used to differentiate surface water resources (Mendiondo and Tucci, 1997; Oudin et al., 2008), valuing them for better preservation (Graf, 2001; sismic and Belij, 2008) or exemplify content for environmental education, as in hydromineral poles from Portugal (Machado and Oliveira, 2010).

The peculiar features occur where the springs are related to the origin of life, evolution, differentiation between species and genetic evolution. The "pre-biotic primordial soup" comes from similar complex aqueous environments due to their dynamic properties of fluid and solvents. Flow volatility and allow exchanges caloric mixtures and reactions that have shaped the planet and resulted in biological activity (Sverjensky and Hazen, 2010).

Stromatolites and other microbial fossils documenting the earliest forms of life have typical habitat correlated the vents with vapors, gases and strong presence of dissolved minerals (Brakmann, 2001). Even today, with great diversity archaea thrive in these environments. The isolation and physico-chemical peculiarities of these sites allowed the selective development of species; ecosystems currently still special biodiversity (Boeuf, 2011). The anatomical features and physiological life evolution, including humans, are strongly related to these proximal waters (Tobias, 2012).

Considering water like fundamental to biological systems, their involvement with the living creatures physiology should begin in assessing the activity of aqueous solutions as a thermodynamic property with potential energy to interact with other substances (Schiraldi et al., 2012). Pure waters itself affect all physiological structure and biological human activity; correspond to hydration essentiality, cleanliness and fluid transport to the living beings. In addition to its healing properties, are essential nutritional functions (Desgrez, 1971; Ghersetich and Lotti, 1996).

One liter of water at 25 $^{\circ}C$ contains 33 x 10^{24} molecules , this, added to their polarity, hydrogen bonding and high dielectric constant make water an excellent solvent , especially for ionic compounds and salts . Therefore, it is very difficult to find naturally pure. There are many abnormalities of water: 7 of stage 12 of density, 9 like material, 7 by thermodynamics and 5 in general physical (Stevens Jr. et al., 1978; Chaplin, 2011). Their main physical-chemical and biochemical natural process are: dissolving, hydrolysis, adsorption, absorption, ion exchange, oxidation, reduction, diffusion, osmosis and suspension (Lynden-Bell et al., 2010).

The waters have uniques natural remarkable properties, largely affecting biological systems. The macromolecules of proteins are structured with relatively large spaces filled with water, so that balance and orient their anhydrous forms much more common than the crystal. The enzymes and DNA would also be inactive without the presence of water. Due to these evident bioactivities, could be considered as *biomolecules* (Ball, 2010).

Thus, the proteins become available a set electrolyte solvent (Pal and Zewail, 2004), increasing the dynamic organic activity and facilitating exchange and several biochemical reactions between membranes (diffusion transition percolation, solvation, hydration, convection, etc.) (Sedlak, 2011).

The proteins solubility control many biological processes and their behaviors are closely related to the ions present in their structures and substances with which they interact. Much of the biological and aqueous solutions related to life have low content of dissolved salts or low ionic strength. Thus, research on the ions effectiveness, together or individually, demonstrate that the protein solubility increases in the solutions of low ionic strength. For example, experiments with lysozyme reveal that at pH 4.5, the solubility is strongly dependent on the solubility of anions and also that, at pH 9.5; it becomes independent of the ionic strength of the medium (Retailleau et al., 1997).

Aqueous solutions with TDS below 1000 mg/l can be considered diluted (or low ionic strength), calling biologic concentration and involved at majority of environment and biotic processes. The classical Arrhenius theory of electrolytic dissociation considers the speed of displacement of the ions does not vary with changing the concentration of the solution, thus the equivalent conductivity with increasing dilution is attributed to the increasing degree of dissociation (Loreta and Atkins, 2006).

The physical property of a solution in a given ionic strength is equal to the property of pure water added to the equivalent proportion of ion-water and ion-ion interactions related (Millero, 1985). Water-water interactions have vastly superior force to the ions and increase its chemical activities in dilute solutions, mainly to the anions (Collins et al., 2007).

For the electrolytic and solubility phenomena, can be used several theories (electrostatic, dipole, internal pressure range and Van der Waals forces), normally expressed by "Setschenow Equation". However, in dilute solutions these models are limited due to the errors observed in the results (Van der Weg, 2009) and various thermodynamic models feature or errors occur as opposed to the expected (Marcus, 2009).

When the net charge of the predominate protein a dilute solution, the activity coefficient is changed, increasing the solubility and the formation of protein bagel salt; going on the predominance of electrostatic interactions. In these solutions, electric order interactions should be especially considered in any studies (Bostrom et al., 2003).

The ions that build or add structures in proteins are called kosmotrops (predominantly hydrophobic effect where there is the decrease of the dependence of solubility of proteins to the value of the ionic strength = "salt out") and those who destroy or solubilizam such structures are the chaotrops (dominant electrostatic effect leads to increased dependency of solubility of proteins with the ionic strength = "salt in"). The minimum concentrations of salts required to precipitate a given protein in a typical 1.0 M aqueous solution, a system of positive charge electrostatic interactions in dilute solutions (which are the predominant) follow the reverse order of the Hofmeister Series (Zhang and Cremer, 2010).

The Hofmeister Series for electrolytes in relation to selectivity and sequence of biochemical reactions with proteins, although discovery in aggregation in a sequential egg white, has been enhanced through different waters and natural salts (Xu et al., 2011). The order of this series for the ions discussed in this work is:

KOSMOTROPIC ***CHAOTROPIC***

$$CO_2 > CO_3^{-2} > SO_4^{-2} > F^- > HCO_3^- > Cl^- > Br^-$$

$$K^+ < Na^+ < Li^+ < Mg^{+2} < Ca^{+2}$$

The first bibliographical revisions to the understanding of the phenomena relating the waters in their deposits with physiological changes, a term draws attention for appearing in many works and constant since the earliest classifications of mineral waters: the biologically active components or in English abbreviated as BAC ("Biologically Active Compounds"). The modes and parameters of intensity relative to these phenomena from the substances suggests correlations with their concentrations, complexities in mixtures, physico-chemical constraints and contact forms; being more well known patterns of biological responses of lipoproteins (Schulman, 1943).

Through studies of the biological activity of sea water in natural aquatic organisms of this habitat observed metabolic and nutritional influence of minerals and microconstituents, inorganic, included in their occurrences in continental waters more diluted (Johnston, 1955).

Believing that such phenomena can serve as parameters to the goals of this work, the presence of biologically active Component or term "Biologically Active Compound (or Component)" will be here abbreviated as "BAC" and under the exclusive focus on potential applications of benefit to human health. Despite many researches the use in medicinal plants, drugs or environmental pollutants, from former works with this focus are found correlations to waters and mineral waters (Johnston, 1854). In recent works on global biogeochemical cycles (of water, nitrogen, silicon, sulfur, phosphate, nitrogen, oxygen and ammonia) or testing of therapeutic efficacies mineromedicinal waters, have been using this term and its acronym BAC (Orlova and Galushko, 2008; Jovanovic, 2008; Shpeĭzer et al., 2010; Campbell et al., 2013).

Some recommended publications on the subject: (Kemp, 1971; Konopac, 1979; Chesalov and Rybakov, 1985; Plotnikova and Nesterova, 1988; Sadikov et al., 1991; Becker, 1994; Lotti and Ghersetich, 1996; Plant and Baldock, 1996; Ponomarenko and Turkovskiĭ, 1999; Roux et al., 2004; Suzdaleva et al., 2004; Ia Koval'chuk, 2005; Jovanović, 2007; Thong and Maibach, 2008; Baroni et al., 2012; Race, 2012).

Based on their biological activities, natural mineral waters can be classified as diuretic, cathartic or antiflogísticas properties. According to the elements predominates, medicinal and biological effects occur (Gautam et al., 2010).

Other biological activities recognized by researchers expert in mineral waters (Mourão, 1992; Drobnick and Latour, 1999/2001/2010 and 2011), are the so-called powers: zimostenic, zimoparalisant, phyilatic, desensitizing or esceptofilátic, antihistamine, stressful, hormoestimulant, quimioestimulant, catalytic bead, cholagogue, choleretic, colloidal and colecistocinetic.

1.2. Objective

The main objective of this study is to detect among existing water sources in Brazil, which might be classified as hydro, through one or more parameters that produce beneficial biological responses (Schulman, 1943) in similar cases already surveyed (Schuffenhauer and Brown, 2006).

The existence of these BAC have potential healing therapeutic indications which, prevention, rehabilitation, improvement of health and well being? Under what forms of exhibitions or applications?

As in any mineral prospecting, you need to know about the natural properties of substances: its forms of occurrence, physical and chemical properties, diversity and minimum content of interest ("content"). With this information, the subsequent search for promising targets is facilitated and ascertained. Finally, in-depth studies being for local selection to be explored, its dimensions and potential economic potentials.

Therefore, the database organization with national inventory of these occurrences, in which the variables are, aggregated here BAC selected by related criteria.

Thus, sought to accomplish the crossing of this information and also of possible comparisons with other similar databases, aiming to differentiate fountains for potential treatments of diseases or health benefits.

1.3. Subject Rationale

The mixed aqueous solutions can add natural warmth, gaseous, inorganic and organic elements in nanoscale colloidal ions, electrolytes or microorganisms with high genetic and physiological influence of all living beings (Salt et al., 2008). The knowledge of this mineral, nutritional factors, biochemical variations in phenotypes and mainly genome of mammals called "Ionomics" (Baxter, 2009).

The waters have natural elements which also underlie the concepts of cutaneous detectable via aquaporins and ion channels, of modern bioengineering (Edlich et al., 1987; Oliva et al., 2010). All these constituents have biological functions, participating in the metabolism with health benefits or negatively, due to toxicity or epidemiological deficiency (Fleet et al., 2011).

The bioactive ingredients are also commonly related to human health pharmaceutical and nutritional area; being several researches in natural ingredients, basically the biochemical properties of plants and algae (Biesalki et al., 2009).

Scientific papers are common, especially in the biomedical area, demonstrating therapeutic benefits through the BAC of waters, gases, slurries and other natural resources from hydro sources (Altman, 2000; Petraccia et al., 2006; Vilà, 2008; Verouden and Meijman, 2010; Vaccarezza and Vitale, 2010; etc.).

The specific actions of the mineral waters are due your Ionic content and the biologically active substances associated with, being also common sense that such forms of electrolyte are among the most bioavailable inorganic elements in any form of exposure (Abady, 1990; Böhmer et al., 2000; Ferrier, 2001; Sabatier et al., 2002; Kiss et al., 2004; Heaney, 2006; Karagülle et al., 2006; Duflot, 2007; Marktl, 2009; Baroni et al., 2012; Nunes and Tamura, 2012).

The therapeutic effects of mineral waters are based on their biological activities, noting the increased biochemical effects due to the high power of diffusion when ingested (Albertini et al., 2007).

Uses of natural remedies are documented in ancient fossils and their millenary medical applications by indigenous people searched for Ethnopharmacology (Franzle and Markert, 2000). The geological materials in healing or even aesthetic uses are known since prehistoric times and still today are important inputs farmacosméticos (Glebets et al., 2010).

Although much of the work in the area of Medical Geology related to Hydromineral fountains, water and natural gases generally focus on the risks with its exhibitions and anthropogenic contamination, fit highlight searches that seek the positive effects or beneficial to health through the mineral resources or environmental processes (Hopps and Feder, 1986; Komatina, 2004; Finkelman, 2006; Gomes e Silva, 2006).

Starting the quest to meet the focus of this work was conducted literature review regarding the terms: waters, groundwater, springs, hydromineral fountains, water resources, health, wellness, health tourism, environment, sustainable development, governance and political strategy.

Such aspects reinforce the need to increase knowledge about these Springs, search for their uses with greater aggregate values and top priority to the welfare and human health. Such "productivity" is necessarily for the practice of conservation, with reduction of risks from contamination and exploitation intensity (low-flow "appliance") these quantitative natural resources (UN, 1992; Hiscock et al., 2002; Falkenmark, 2011; Findikakis, 2011; Gleick et al., 2011; OECD, 2012; Shuster, 2012; GWP, 2012; UNESCO, 2012; Roumasset and Wada, 2013).

The concept of cultural heritage (and/or natural) of mankind, when it involves traditional medicine, it is considered as natural ingredients regional therapeutic activity those able to prevent, diagnose or treat physical and mental disorders with historical efficacies.

Act on the symptoms of the ills, promoting beneficial changes or regulating the human body State; being typically prioritized the popular medicinal herbs. Not be possible to identify the activities of all ingredients, is considered a single main for its full biological activity (UNESCO, 2001).

Much of the traditional medicinal (or indigenous) is based on bioactivity of natural products (Kumar, 2009). In addition to archaeological and paleonto correlations, are various types of living beings that have relationships with such private ecomorfologias or special crenobiologias: mammals, fish, birds, insects, vegetation, algae and micro-organisms (Spitale et al., 2012).

The medical specialty of crenology or hydrological medicine is directly related to Hydromineral fountains and their aggregates, being that these natural resources potential therapeutic also underlie therapeutic techniques, such as: Homeopathy (Chaplin, 2007), "hormesis occurs" (Oberbaum et al., 2010), orthomolecular, "onsen" (Serbulea and Payyappallimana, 2012), "kuror" (www.dgpmr.de), "Kneipp" (Michalsen et al., 2003), "priessnitz" (Vincent Priessnitz, 1829), Thalassotherapy (Russell, 1760), balneo-hydrotherapy (Moss, 2010) and Ayurvedic bhasma "(-" Raisuddin, 2004).

Resources and natural products of the three kingdoms and even environments (Milligan et al., 2004), have been used for a long time and increasingly searched before their BAC currently representing 60% therapeutic clinical trials in search of pharmacophore, remedies or drugs (Qurishi et al., 2011).

One of the benefits with more recent approaches and considered indirect are: the balance of the ecosystem, recreation, tourism, better education and income levels, quality of life for the elderly and women's access to the labour market (Barlow and Clarke, 2002; OECD, 2011; WWAP/UNESCO-IHP, 2012).

The uses of hydromineral fountains in leisure activities, health and well-being are economically profitable, socially and environmentally weighted evolutionary. The knowledge and preservation of springs has importance in: geology, ecology, agriculture, general Sciences, water resources, and drinking bottled water, leisure, balneotherapy, hydro and geothermal energy generation, cultural e social (Stevanovic, 2010).

Interest in the evaluation of bioactivity covers biochemical phenomena, pharmacological, nutritional, medicinal and ecological. Thus, their distinct values, dependent on their bodies and the bioacessibility. The dose bioavailable for absorption, distribution, metabolism, excretion and toxicity (ADMET) of a substance for human health has great influence in the manner, time and amount of exposure; In addition to its physical-chemical properties (Strachan, 2010).

Currently, in procedures for medicinal chemistry and drug discovery pipeline ("drug discovery"), the greater solubility of components in water is characteristic of first importance to their pharmacokinetic and pharmacodynamic tests initials (Balakin et al., 2006).

In studies on pharmacognosy few references are about the water and mineral products; among the total of drugs recorded by the main agencies and global authorities (27,329), inorganic salts//the solvents/gases/metals add up just 1.95%, however, among the total of active pharmaceutical ingredients (API) approved for humans (9,524), the increase to 5.38% abiotic total (Huang et al., 2012).

Some minerals are available to him under the laws of the United States as dietary supplements and dietary ingredients (USA, 1994). Dietary deficiency of many epidemiological elements (macro and micro inorganic) can decrease the quality of life and cause various types of diseases, being the waters potential providers of many of these mineral nutrients (WHO, 2005).

About 21 mineral elements are known or suspected to be essential for humans: Cl-, PO4-3, Mo2+, F-, Ca2+, Mg2+, Na+, K+, Fe2+, Cu2+, Zn2+, Mn2+, I-, Se2+, B3-, Cr, Ni, Si, V2+; nutritional importance have not yet been completely (WHO, 2005). For many the nutrients bioavailable fraction is high (over 90%), but for a large part of inorganic elements is low, and also great variation in the physiological uptake of some ionic species.

ABSORPTION	**FRACTION**	**ELEMENTS**
Low	<25%	Fe^{2+}, Mn^{2+}, Cr, Ni, V^{2+}
Medium	25-75%	Ca^{2+}, Mg^{2+}, Zn^{2+}, Cu^{2+}, Se^{2+}, PO_4^{-3}
Hight	>75%	Na^+, K^+, Cl^-, I^-, F^-

Source: Fairweather-Tait and Southon (2003)

In any historical summary for cosmetics, aesthetics and beauty will be basing your home cleaning, the baths and the minerals. With difficulty to access these natural resources or the difficulty to benefit them, around the year 1200 the individual baths, homemade ornaments and portable perfumes began to be developed. The cosmeceutical or dermocosmetics as industrial and research process was greatly influenced by the pós-colorantes ("make up") of mineral origin and primarily by evident cutaneous effects topically obtained by thermal muds, from French SPAs.

Some specific uses of the unusual mineral waters in Brazil: in pregnancy, elderly, sportsmen (tonics), lactating mothers, babies, youth, menopause, cosmetic, "skincare", alkalizing, nutrition, "diet", taste, laxatives, antiseptics, bactericides, nutricosmetics, pharmaceuticals, dentistry, aesthetics, etc.

Countries with tradition in these applications define mineral waters also relating the presence or absence of physical and chemical properties associated with the pharmacological actions of these natural water resources, according to the groups: action pharmacodynamics or with its potential, influence hormonal and enzymatic processes of living organisms, toxicity to humans and biological influence still unknown (Komatina, 2004).

Currently in Europe discusses the taxonomic unification for Hydromineral fountains and are stepped up searches on your BAC, in function of their contents, reviews, applications, information and relevance of other BAC unknown (Coccheri et al., 2008; Eyzaguirre, 2008; Gutenbrunner et al., 2010; Varga, 2010).

Many consider that these substances, even in extremely low concentrations, can cause profound physiological changes in living things and eventually with therapeutic significance, as is the case of minerals from the healing waters, which since the very uses the potentiation of biological activities such as electrolytes in health, however, without full understanding of these phenomena (Baudisch, 1943; Hopps and Feder, 1986).

Groundwaters usually have higher content of biologically active components and are natural remedies for healthy healing effects on the human body as occurs in many parts of the world (UNESCO, 2004). The increased knowledge regarding BAC is essential to environmental sustainability and its definition increasingly approaches to physiological effects when in low concentrations, especially evaluating risks of contaminants or natural constituents of surface water or groundwater (Konopac, 1979).

Mineral springs with potential biological effects for medicinal applications usually do not represent more than 15% of the total national water resources, making it even more precious this mineral; regular inducer of sustainable development to its rural communities or urban and whose natural endowment is quite promising (Papp and Szuetta, 2007).

CHAPTER 2
SUPPORTING FEATURES

2.1. Traditional History

Indigenous or traditional medicine makes use of therapeutic waters and its natural sources since ancient times. Modern medicine has had on the health benefits of hydromineral fountains, the Greek beginning of its development. The first worldwide since 1780 pharmacopeas, prescribe various types of natural mineral waters as bioactive external applications and effective via ingestion, for treating various diseases (Nocco, 2007).

Beyond inspiration to modern medicine, natural mineral waters (and their inorganic wastes) substantiate the first pharmacopeias, as: Pharmacopoea Genevensis of 1780, Borussica of 1799, Gallica of 1818, Helvetica from 1933, among others. Important European scientists from the pharmaceutical area worked with mineral waters as: Klaproth, Trommsdorf, Lampadius and Fresenius (Nocco, 2007). Other renowned primordial chemicals like, Arrhenius, Lavoisier and also guided many studies in aqueous solutions and their electrolytes (Castro, 2012).

The first work found describing the baths as natural remedies and differentiating the types of waters in indications for specific cures for various diseases, discusses experiences in Italian sources as Fornello, Castiglione, Monte Comano. Immersion techniques were employed, shower, fango (mud), sudatorium and arena (Office) medical (Iasolino, 1588).Almost at the same time, others also addressed the major known diseases relating them with treatments through some kind of water, especially in Germany, according to concepts of therapeutic practices and European pharmacopoeias (Bauhinus, 1598).

Publications where the waters have their mineral, gaseous components and physical being differentiated by specific curative powers ' relations, dating back to the early days of the printed editions (Le Givre, 1659; Limbourg, 1754; Peale, 1887; Weber and Weber, 1896). In 1931, the contaminant hydrogeologist Vernadsky proposed classification of natural waters based on therapeutic balneology, organized into 19 kingdoms, 43 sub-kingdoms 43, 143 households and 531 species (Vasilievskij and Pogrebov, 1938).

The relationship of the springs with the perception of a sustainable future is quite old and unavoidable magic appeal ("gushing well"), spiritual, religious ("holy water and miracle water") and dressing ("fountain of youth"). Provided that describe the sources in human history, are associated with beneficial or therapeutic observations of its waters with peculiar components and hidden environments (Lamoreaux, 2005). In the Bible are connected to flood by an abyss (Genesis 7:11), in various references as "water under the Earth" (Exodus 20:04) or in hydrothermal vent of Hierapolis which helped in the treatment of some health problems (letter to the Church in Laodicea 3:14-22) (USGS, 2010).

In China, the Lisban hot spring has been used for medicinal purposes since the monarchies 1134 BC between 460 to 370 BC, scholars such as Hippocrates considered a bath more than simple hygiene measure, being healthy and beneficial for most diseases. Recognized as the "father of medicine", proposed the hypothesis that the cause of all diseases in the imbalance of body fluids. Recommended for such a change of habits and recovery environments, also including baths, massages, hikes and sweating. However, it was the Greek physician Asclepiades (124 BC) who introduced in Rome the fundamentals through hydrotherapy baths and water intake (Burns, 1981).

The therapies and SPA experiences, globally distributed, constitute the translation into the English language of thermal medicine or, for example, hydrotherapy at the height of the Roman naturalist Pliny cites "Sunt Thermae Medicinae Optima Pars" which translates as SPA is the best medicine. The term SPA can be derived from Valonese (present-day Belgium) "espa" meaning and source terms tauroggen with healing waters known since the XIV century, or also the translation of the Latin word "spagere" indicating moisten for scattering or dispersion; or as it is more commonly disclosed, originated from Latin anachronism of the phrase "salus per aqua" being the health through water (Tubergen and Linden, 2002).

2.2. Correlated Legislation

The Brazilian Federal Constitution of 1946 attentive to caring for the thermo-mineral waters in their offices after being laid down in previous legislation the code of Mines of 1940 and 1945 Code of mineral waters (Decree Law No. 7841 of 8/8/1945). Law No. 2661 of 12/3/1955, seeks to guide the spa towns and encourage the States where they are, and some they formulate its own laws to implement such federal aid, such as Rio Grande do Sul (Law No. 474 of 5/8/1958), Bahia (Law No. 1451 of 8/10/1961, among others), São Paulo (Law No. 10426 of 12/8/1971, among others), Minas Gerais (State Constitution of 1989), Santa Catarina (Law No. 1813 of 1/5/1994) and Rio de Janeiro (Law No. 274 of 12/28/2004).

After attempting to update this legislative framework through the workgroup for characterization and classification of the Brazilian natural mineral waters (GTCAM), with project provided for in Ordinance No. 337 of MME of 7/19/2002 (BRAZIL, 2002), other legal inferences are being made regarding the preservation of mineral waters and their therapeutic uses. However, some authors consider the current political management hidromineral productivist and focused excessively on Brazilian bottled water, becoming an obstacle to environmental protection and transformation of the spa towns of the country (Ninisi and Drummond, 2008).

The most recent action of the Ministry of mines and energy's Ordinance No. 127 of MME 3/25/2011 structuring technical roadmap for the preparation of the project of characterization crenoterápica (Ordinance No. 374 of MME 10/1/2009), where in its annex are required some of the variables of these mineral resources and their environments that are also compiled in this work, as: origin of discharge (gushing well), geographical (local) origin, classification and characteristics, characterization of the main mineral elements contained and its beneficial actions on the human organism, scientific information relating to chemical composition, physico-chemical and microbiological for purposes of rationalization of use outside the consumer public, classification based on mineral water code and related legislation, aspects of the therapeutic properties and potential uses.In the health sector, the SPA is included in resolutions CIPLAN of 1988, paragraph 343 CNS of 10/7/2004 as a tool for strengthening the definition of governmental actions that involve the revalorisation of the springs of mineral waters, therapeutic aspect, mechanisms of prevention, surveillance, control and encouraging the implementation of related research.

Next, the gatehouse MS 971 of 5/3/2006 approves national policy of integrative and complementary practices (PNPIC) in the unified health system (SUS), citing that our country enjoys natural and human resources social development ideals balneology/crenotherapy, whose approach has recognized indications to mineral water uses for health treatments. And in another demand that this work can assist, is in this ordinance set up as a priority by the Ministry of health increased efficaciousness, support in research and development of different approaches, which help to improve these services, making available preventive and therapeutic options to users of SUS (unified health system).

With respect to the environmental management of groundwater resources, may be of interest to the resolutions MME/CONAMA 396/2008 and MME 107/2010, also worth quoting major breakthrough formalized by the tourism ministry to publish the basic guidelines for the tourism segment of health and wellness, where again it is recommended to increase knowledge on the national inventory of the occurrences and the characteristics of natural attractions and hot or mineral fountains (BRAZIL, 2010).

2.3. Economic interests

In the year of 1992, were estimated at more than 4 billion people worldwide who have used the hydrotherapy in SPAs, health resorts, spas and sanatoriums of pension systems, and only in the SPA industry are employed approximately 15 million people, with a total income of US$ 30 billion. This time, the German market of natural mineral waters represented value exceeding US$ 2 billion (Fricke, 1993). In the following decade, the more than 50,000 SPAs have aggregate turnover to US$ 250 billion (Palma, 2006).

Although not more than cover balneology 2.5% of the total health services in complementary, alternative or integrative medicine (CAIM), the more than 1000 SPAs Brazilians showed a revenue of US$ 370 million in 2012, accounting for about 300000 visitors have increased by 10% per year (ABCSPA, 2013).

The health systems of different countries pay a large part of the thermal treatments and stays in these places, being found not only social advantages, as cost-effective (Pratzel, 2001; Klick and Stratmann, 2005; Coccheri et al., 2008).

Currently are 500000 the curistas or hydrothermal patients of all ages and under medical prescriptions submitted to crenotherapy intensive 18 days in France, with an average individual spending at US$ 700.00 totaling an estimated annual volume of business exceeding US$ 1.5 billion. Of this, 65% is subsidized by the national pension system, representing only 0.3% of public expenditure. Its 118 thermal centers generate 100000 jobs, representing tourist segment of health responsible for 25% of the total of this activity, that induce socio-economic indicators comparative advantages of their communities (Freire, 2013).

Recently been developing the ideology of water networks and spaces or "premium" cities, which have particularly favourable for more quality of life. Water quality is of first importance item in this assessment, through its purity and epidemiological value on drinking in public distribution (Boland, 2007). In China, such special properties in the waters of hot springs that provide leisure, tourism, wellness, medical treatments and industrial traffic jams, are also considered as of great potential resources development inducer of regions of type "premium"; and should be preserved and researched (Li, 2008; Xie, 2009; Chen and Huang, 2009).

The strategic planning and the importance for the sustainable development of 230 enterprises related to the island of Taiwan hot springs have been widely discussed and researched by all segments involved, including opinions of more than 4 million visitors per year, that demonstrate preferences aimed at nature of each occurrence (Lee and King, 2008; Lee and King, 2009; Hsu, 2012).

Search using reference to tourism statistics methodologies demonstrated that in countries where the SPAs and health resorts are big contributors to the gross domestic product, like Spain and Slovenia, the preferences for local selection, both the visitors as of entrepreneurs, also prioritize the bioactive properties of the waters and the landscape scenic beauties (Snoj and Mumel, 2002; Alèn et al., 2006).

The relationship of thermal and mineral waters with therapeutic properties and values of interest are potential inductors of sustainable development, being necessary policies and strategic studies for its exploration and preservation for all countries in the Asian Pacific region (Baker, 1999). In this context, the oldest experiences, practical applications and specific searches are in Japan, where the philosophy Onsen is popularly used in the thermal baths of immersion (Nasermoaddeli and Kagamimori, 2005; Erfurt-Cooper and Cooper, 2009; Serbulea and Payyappallimana, 2012).

In Russia, since the days of the USSR, sanatoriums, hospitals and public institutions of balneotherapy are of great social value and wide popular use, being recently implemented health resorts and SPAs, which add up to more than 500 units in this country. The estimated volume of demand in water of 10 to 100 m3/day in a drink bottling industry or in a conventional balneology center; 1,000 m3/day at a large health resort and at a crenotherapy center with just drinking uses is 5 to 10 m3/day.

The Russian total groundwater to hydrotherapies demand was estimed at 100,000 m3/day, while for irrigation overcame a volume 26,000,000 m3/day.

In this country, are the most ancient and complete research on the differentiations of mineral waters according to their BAC, as well as related legislation. It is also of great wealth to the current scientific literature on clinical trials of its medicinal waters, especially through Voprosy Kurortologii, Fizioterapii, Lechebnoi i Fizicheskoi Kultury (Vartanyan et al., 1985; Bihari-Axelsson and Axelsson, 2002; Povazhnaia and Bobrovnitskiĭ, 2013).

In Turkey, the use of natural and cultural resources for tourism, especially in its more than 1500 hot springs, corresponds to only 5% of natural endowment and are suggested more research about your referrals, urban planning and landscape hidroterápicas for the promotion of this desired sustainable segment – "green economy" (Oğuz et al., 2010; Topay and Küçük, 2010; Ataberka and Baykal, 2011).

The reduction in the costs of the Italian public health system is evaluated in study of comparative effectiveness between thermal therapies and the pharmacological treatment of gastrointestinal diseases (Gasbarrini et al., 2006). Also relevant is the description of the peculiar benefits of thermal medicine employed in healing, prevention and rehabilitation for most health problems, adding to the sustainable uses of natural resources characteristic thermal springs of Spain (Maraver et al., 2012).

Example similar to the Brazilian environment is described by the advantages of the warm and sunny days in the region of Queensland (Australia) on the efficacies of climatic therapy applied in more than 82 health resorts, to post-traumatic treatments of cardiovascular and neurological problems. In this country, the main district termomineral is in Victoria (Bennett et al., 2004; Shugg, 2004).

Other examples can be cited as: the structuring of the sustainable development strategy of the hot springs of Sagole in South Africa (Tshibalo, 2011); the influence of spatial management in areas with therapeutic waters used for SPAs, in the quality of life of their communities in Polish regions (Krol and Kot, 2010); economic income generation by thermal tourism productive systems in regions of Portugal (Ladha et al., 2002); in the lasting perception of quality of life for residents and visitors of the traditional thermal centre of Bath in England (Atkinson and Davison, 2002).

The great interest in the tourism industry can be justified by the participation in 9% of global GDP, with the volume of US$ 6.3 trillion and generation of 255 million jobs (one of each 12 workers in the world). For Brazil, is designed a growth of 7.8% in its annual revenues of US$ 127 billion/year, corresponding to 3.6% of GDP (OECD, 2013). As for the domestic tourists who travel for health reasons or to visit Brazilian balneo-climatic stations, it is estimated the contribution around 10% among all tourism segments (BRAZIL, 2007).

2.4. Social Benefits

Among the 560 Brazilian municipalities with the best human development indexes (HDI exceeding 0.8) in 2000, the SPA towns are 35 (Rahman et al., 2008). In the States of São Paulo and Minas Gerais all are highlighted (Andrade, 2012). Águas de São Pedro, São Paulo has the second national index, Poços de Caldas/MG the highest in your state, with São Lourenço/MG in the third position. In Santa Catarina, one of the 20 municipalities with better HDI, are 6 the spa towns and among these, in the States of Rio Grande do Sul and Goiás, 3 representatives.

The differentiated and intimate relationships between the communities of spa towns with their sources and natural resources are evidenced in Brazil historically. Such links tend to be on attachment to identity of origin, influences on income or professional activity, social development better distributed sense of preservation and effective participation in governance or political strategic planning.

Some of the peculiarities of these healthy environments are the values: a) relating to cultural sites, historical significance, whose natural aesthetic features forming a valuable scenario for society; b) intrinsic to ecosystems, which regulate the processes and nature resources stocks, such as mineral water, their medicinal properties and the hydrological cycle; c) directed to the conservation and preservation in the diversity of nature (Taboada, 1870; Nunes et al., 1999; Freitas et al., 2003; Mota, 2003; Franca and Ribeiro, 2010; Gomes, 2011; Marrichi, 2012).

In the face of a global trend to nutritional deficiency in minerals and trace elements mainly for, even in the richest countries (Campbell, 2001), it is worth highlighting the potential importance of groundwater (mineral drinking) as your essential source for the Brazilian diet, especially for children from poor communities (Cozzolino, 2007; Bueno et al., 2013).

The chronic non-communicable diseases (NCD) affect less than 30% of the Brazilian population, however, afflicting over 70% age group of older people and are responsible for the same portion of total mortality (PNAD, 2008). Once these main pathologies exist crenoterápicos clinical trials of efficacy in healing, reduction of symptoms or improvement in quality of life, are expected to contribute in this governance for social welfare, economic effectiveness and environmental rationality (annexes frames: 1. main CHRONIC DISEASES in BRAZIL, 2. MEDICINE SPECIALTIES and 3. DIFFERENT EFFICACIES IN ITALY).

In addition to the traditionally treated diseases, the French crenotherapy doctors syndicate plans to emphasize potential applications: fibromyalgy, Alzheimer 's, Parkinson 's, stroke, multiple sclerosis, post-traumatic restoration, disables sequels, mental disorder, memory and muscle mass losses; as well as preventive and rehabilitation programmes to obesity, diabetes, smoking, alcoholism, drugs and aging (Freire, 2013).

The cost for one week at thermalism treatment is estimated US$ 500.00, for a complete SPA therapy during four weeks and with medical follow-up, the values range from US$ 2,000.00 to 27,000.00 (WHO, 2005).

Recent statistics revealed that the chronic disease of higher incidence in Brazil is the systemic arterial hypertension, followed by back pain, which in the United States cost annually up to US$ 90.6 billion, contributing with 14.5% of total health spending (Magalhães et al., 2012).

2.5. Environmental Advantages

Special and unusual characteristics of springs often produce microenvironments with morphology, physical chemistry and differentiated ecosystems. Study their properties have aided in the hydrological knowledge, hydrogeological, geological, biological and anthropological resources related environments (mango, 2001).

Ecosystems can depend on groundwater directly or indirectly, as well as the connections to surface waters, aquifers provide the differentiated water biota and protected from surface exposure, nutrients and minerals, as well as a relatively stable temperature (Krauskopf and Loague, 2003).

Although all important functions related to water sources, in most parts of the world there is ignorance, contempt and the deterioration of these types of springs, especially in the smaller occurrences and in urban areas (Sada and Keir, 2006). And the most obvious exceptions are in some European countries and Japan, where this attention and sense of preservation if checks on traditional uses of these water sources for baths, therapies, wellness and tourism. In France, many of these fountains are shown to natural and cultural heritage sites (Feru, 2004).

The care and political strategies related to springs must fundamentally recognize his delicate position interface between 3 distinct ecosystems (groundwater, surface water and the impacts of human activities) and so relieve the whole range of their environmental and social values (Barquin and Scarsbrook, 2008).

With over 12% of the global surface fresh water and stored volume estimated at 112000 km3 in aquifers to less than 1000 meters deep, mostly still preserved and with good quality for human consumption (WWAP, 2009) the Brazil deserves that such resources are better known and valued.

CHAPTER 3
METHODOLOGY

The main keywords and terms cited in this work have more specific descriptions (ANNEX GLOSSARY).

Don’t belong to this approach observations concerning at current preservation or pollution stages, toxicology related to water components and possible contraindications in their therapeutic uses.

As in a work of research and mineral prospecting unconventional, as a first step the natural properties were evaluated that could be exploited and its minimum contents (content) for economic exploitation of mineral deposits or reserves estimate (Maranhão, 1985).

With these "prospecting", the second stage consisted in the removal of the largest possible number of data about such cases estate located in the region of focus; in this case in Brazilian municipalities. Finally, in the third step, were established the targets of greatest potential to detailing future research through the intersection of the two sets of previous information (Winge, 1995).

In the first step of the bibliographical research sought to identify what are the possible components related to mineral fountains capable of producing effects sensitive to living organisms and how these biological activities are evaluated in their benefits.

Therefore, the selection of keywords to be consulted used not only the main related therapies related to waters, minerals, inorganic elements, gases, natural environments and their physicochemical properties, having as means of exposure, short-term or long-term, dermal contact, immersion baths, ingestion or inhalation.

Knowing the Brazilian scarcity of research on theses focus, were compiled international experiences, mainly countries addressed common practice related to medical hydrology. Thus, for later comparison to national resources were used in the main search engines, net related with scientific publications and databases with information about evidence in healthcare (life sciences), especially systematic reviews, meta analysis, equivalence testing and clinical trials. The key words used in specialized digital database originated many initial compilation works (ANNEX TABLE 4. KEYWORDS IN DIGITAL DATABASES).

Adopting the definition of BAC in their exhibition forms to living things, such as natural resources and environments of therapeutic effects (RNT), were selected those in which observe such potential associated with thermo-mineral fountains. Consultation under this approach, in publications resulting from this compilation allowed suggest a total of sixty (60) variables "BAC" (ANNEX TABLE 5. SYMBOLS TO 60 BAC APPROACHED), thus grouped:

i. Environmental, socio-economic features and its own historical localities where the sources

ii.Climatotherapy types because of latitude, altitude, albedo and bioklimatic micro environmental particularities along fountains

iii.Radioactive gases from the outcrops

iv.Physical properties potentiated by spontaneous flows

v. Water temperature in deposits

vi.Potential of hydrogen (pH)

vii.Gases dissolved in water

viii.Total dissolved solids (STD) and total hardness (Dur)

ix.Electrolytes anions macro

x. Electrolytes macro cations

xi.Microelements (Oligominerals or traces).

Minimum levels (and some times max) for potential bioactivity of each BAC were selected through criteria with parameters that might be targeted:

1. Scientific articles of screenings, meta-analysis, systematic reviews or clinical trials (MED)

2. Brazilian legislation related to mineral waters and their water sources (LEG/BRA)

3. Legislation or related International policy, especially Europe, Japan, USA and Cuba (LEG/WORLD)

4. Patterns and values studied or established in nutrition, dietetics or epidemiology (NUTRI/DIET/EPIDEM)

5. Standard, research and technic customary to hydrotherapy, balneotherapy, crenotherapy, SPA therapy, climatotherapy, Onsen or phamaceutical (BATH/SPA/ONSEN).

Subheadings are brief descriptions of all 60 BAC, about its forms of occurrence, summaries of work quantifying biological efficacies and with indications of their applications, which have been reviewed systematically for the MED, NUTRI/DIET/EPIDEM and BATH/SPA/ONSEN. Being cited in text by prepending the symbol of the BAC by M, D and B, respectively. Such selected values are bolded.In all 60 BAC were selected values or parameters considered of interest to deepen studies on its potential biological activities for health benefits, being listed in the first segment (MED).

The main criterion in the evaluation was the lowest value found in description of your clinical trial parameterized for comparison or proven efficacy. When such non-existed, tradition or custom popular of its uses have specified their presence or classification of that water. In situations with several related searches, the minimum value followed the more commonly quoted or when proof of effectiveness possessed better reasoned methodology.

Could also be followed as criteria, technical studies with reviews for SPA resorts facilities or health resorts, based on advantages of hydrotherapy practices.For the BAC of the 1 number 17 (groups i, ii, iii and iv) only one thread has been described and is therefore considered MED due to lack of legal parameters, nutritional and balneotherapy therefor, as well as by being physical, environmental components or free gas.The types related to locales (BAC in 1 to 5) and climates and elevations (BAC in 6 to 11) are related to the environment and climate, being their physiological reactions in sought-after bioactivity offered in rural or urban spaces of tourist resorts, weather phenomena, geological and social, as well as other natural resources, pleasant landscapes and therapeutic bioclimatismo.In components where different values in its properties also provide different types of biological activities, were made in subdivisions that each represents a variable of BAC. Are they the temperature (BAC in the 17 to 22), pH (BAC in 23 to 27) and the total dissolved salts (BAC in 32 to 37).

The segments for selections of the BAC values involving specific laws laid down in directives to mineral or water mineromedicinal, when compiled internationally, were selected at the lowest found, the most common, European legislation or what has in its grounds connect to display type evaluated, as for example, in baths or dietary factors.

As Brazilian law follows basically the code of mineral waters of 1945 and, for some values not provided under this Ordinance, MME 337/2002 (GTCAM) and minimum analytical detection levels of official laboratory (LAMIM/CPRM, 2012) in trace elements.In most of the BAC assessed by segment criteria NUTRI/DIET/EPIDEM minimum values were conditional on content of total dissolved salts (STD) less than 1000 mg/l, because this is the maximum recommended concentration on daily consumption of drinking water by various international institutions (IOM, 2003; USEPA, 2009; WHO, 2011). For similar reasons, this is the almost exclusive segment also limiting maximum values to BAC.

As a result, was generated a database in Microsoft Excel software (2010), whose illustration contains also the symbols here adopted for each BAC and its references (ANNEX TABLE 6. SYMBOLS TO BIBLIOGRAPHIC REFERENCES FOR BAC SEGMENTS).

In a second step, numerical data of the same variables BAC were sought in scientific publications, academic papers, technical reports, digital portals, databases, public or personal hidroquímicas analyses and advertising materials, to the largest possible amount of samples in Brazilian hydromineral fountains. This search included the different ways in which occur naturally or as are used, for example: springs, wells, wells with jorrantes waters, groundwater, drinking water, hot springs (hot), miraculous healing (holy), lavras minerals law, tourist resorts, SPAs, spas, aquatic recreation centers or industrially bottled.

All values are concentration in mg/l, temperature in °C, and radioactivity in Bq/l. due to application following this work or help of the analyses, were also selected other variables to compose this database, such as: name of the municipality, federation unit, name of location, current form of economic exploitation, form of explotation (l:place of hot water, n:spring, p: well or j: well gusher), depth (m) catchment, topographic elevation (meters above sea level), latitude, longitude, climate (Koeppen-Geiger), electrical conductivity (EC in µS/cm), geology, hydrogeology of the aquifer which it is enveloped (Province and Domain – MMA, 2002) and crenológica classification adopted.

As a preliminary result was obtained unprecedented listing of 44 water sources with denominations or "powers" popularly related to religion (miraculous or santa) and shamanism (curative). Also obtained relationship with 86 locations whose names are associated with thermal or hot water sources: city, district, street, neighborhood, river, river, creek, stream, spring, source, well, pond, waterfall, mountain, hill, fountain, SPA, warm, caldae, etc.

This prospect, were raised more than 2000 physicochemical analyses results and related data. Its origins and literature consulted were codified and when at least one of its variables was used in the end result, its reference in the grouping of general bibliography database, also described the amount of times that each work participated in compiling a health source sample.

With the absence of various data and the repetition of others, the data were processed according to the following criteria:

.For unique samples of the same occurrence or with little information, were considered only the variables constants for comparative assessments of the BAC.

.Thermo-mineral fountains with more than one analysis and where the data are distinct was prioritized physicochemical analysis latest original, coming from the government laboratory (LAMIN/CPRM), followed by the criterion of credibility, timeliness of bibliographical reference and greater stoichiometric balance (relationship between cations and anions or with the total dissolved solids).

.Data with anomalous values were conferred in other references, or removed.

This first treatment resulted in more than 700 samples of hydromineral resources for structuring the database. The decision by a brief formatting of this inventory can be explained by objectivity in research, clarity in geographical illustrations, statistical abstraction and reduction of errors.

Thus, the samples were summarized for just one occurrence of hidromineral source per municipality, being selection criteria: its use in locker room or public baths, occurrence as source, highlight the BAC, data availability and lower Ionic balance error (CBE). As a result, was retrieved from an inventory of 525 municipalities with approved health sources sorted numerically to the composition of the database "SPRINGS BRASIL", which was used in the following steps of this work.

The geographical coordinates and altitude (BRAZIL, 2011) were inserted into the worksheet for use in ESRI software-ArcGIS (2011). The points were digitally spatially georeferenced to better illustrate the work and allow this to some plot overlap thematic maps to aid of geopolitical characterizations, hydrogeological, climatic and tourist (ANNEX MAP 1.BRAZIL MACRO POLITICAL REGIONS GEOREFERENCED SPRINGS and 2.BRAZIL NUMBERED SPRINGS).

With the order, was also compiled comparative international inventory containing similar set of variables BAC here considered, with selected origins of hot springs ("hot springs"), source underground mineral waters ("groundwaters"), bottle beverages ("bottled"), SPA ("healing") or potable ("drinking"). Such information, translated into total averages, helped in understanding of proportions, parametric statistical comparisons and correlations or hidroquímicas with the Brazilian and data of the BAC.

To better understand the results, detect anomalies, decrease errors and assess genetic correlations were drawn, Piper and Durov diagrams by the insertion of data SPRINGS BRASIL in software for water quality Aq.Qa 1151 (RockWare, 2006), which was also used for the calculations of ionic balance (CBE) in filtering for analytical errors. The collation of data distinguished himself by the provinces and hydrogeological domains.In the third step each BAC database variable SPRINGS BRASIL had its copied data into a new worksheet individually, always accompanied by the following information: # (ID number), UF (federative unit), municipality, and STD (total dissolved salts), being so ordered (ranking) by its decreasing values.In this step, we used the previously formatted worksheets with the minimum values for bioactive potential in each BAC and variable according to the three segments of selective criterion: medicinal (M), balneotherapy (B) nutritional/dietary/epidemiological and (D), identified with these letters prefacing each symbol of the BAC, for example, BSO4, DSO4, MSO4.

For samples containing values above the minimum, plus column containing these codes and separated (with the data of the variables of #, UF, municipality and symbol of BAC accompanied the segment - MSO4, for example), for pasting into a new worksheet where all these results for all BAC were grouped in the same columns (A=#, B=UF, C= municipality, D=spring, E=BAC value and F=BAC symbol preceded parametric segment).

This new worksheet that contains all potential BAC present in significant sampling of hydromineral sources of Brazil, was made the planning of municipalities alphabetically. The final spreadsheet was constructed by listing all municipalities with approved health sources who own BAC itemised.

CHAPTER 4
STANDARDS AND GUIDELINES

4.1. International

Qualifying policies were considered legislation, standards, codes or recommendations related to fonts, medicinal mineral waters, drinkable or bottled according to their physical, chemical and biological natural characteristics. In countries where hidroterápicas practices are regulars and their main established parameters historically, policies are referred to as specific legislation. For example, Cuba, Spain, Russia, France, Italy, Japan, Poland, Germany, Ukraine, Hungary, Bulgaria and Argentina (ANNEX TABLE 7. MINIMUM VALUES OF CLASSIFICATIONS OF MINERAL WATERS IN INTERNATIONAL LAW). Recommendations were also observed for SPA experiences disclosed by European Association (ESPA, 2006) and North America (Lund, 2000), this sector.

Generally, these policies do not have large differentiations regarding types of waters, in the parameters adopted and their quantification. So, like most examples are on the European continent, to check the values in this segment of potential bioactivity provided for in international law was given preference to the policy of the classifications provided for in European Union (EU, 1980/2009).

As part of this compilation, were abstracted the main therapeutic indications for each of the qualifying components of these policies that, although they are similar, they have jobs and diversified crenotherapy research and who were often mentioned in the descriptions of individual BAC (ANNEX TABLE 8. CRENOTHERAPY INDICATIONS).

The forms of applications considered are:1.Crenotherapy recognized in legislation or by public health systems; 2.Daily Intake or on special diets, nutritional; 3.Crenotherapy only via ingestion or inhalation,4.Thermal therapy for body or localized immersion and several baths.

4.2. Brazil

The main policy for classification of thermo-mineral fountains in Brazil follows the code of mineral waters (Decree No. 8/8/1945 of 7,841), not very different from legislation currently adopted worldwide and providing medicinal actions on the water and dissolved gases or with spontaneous discharges in own sources. Through its natural physico-chemical properties are differentiated minimum values for use in bathing and/or drinking. It is believed that these can also be inferred the uses in inhalation and bottling, respectively.

About the gas thoron, due to its short half life and lack of information considered here their occurrence only in own source in dissolution and/or emanation, being its minimum content laid down by the same legislation (BRAZIL, 1945) of 2 units per litre or mache 26.9 Bq/l.

For temperature, were followed by the values for the cold sources (< 25°C), isotermais (36° to 38°C) and hyperthermal (> 38°C), being grouped the hypo and meso-thermal as the BAC thermal (25° to 36°C) and lukewarm BAC the temperatures (20° to 27°C) (BRAZIL, 2000).

With respect to pH, noted the range established for waters of natural sources for particular food consumption between 4 and 10 (AUSTRALIA, 1978).

The BAC in the waters of dissolved gaseous hydromineral fountains were selected according to their minimum values proposed by the GTCAM working group: radon (70 Bq/l), sulfide (0.02 mg/l) and carbon dioxide (200 mg/l) (BRAZIL, 2002). For dissolved oxygen, followed by the following condition: quality standard for freshwaters of class 1 (> 6 mg/l) (BRAZIL, 2005).

The different levels of fixed residue of minerals to 180 °C followed the classification BAC to total dissolved salts (STD): oligomineral (< 100 mg/l), medium minerial (100 to 250 mg/l) and mineral (> 250 mg/l) (BRAZIL, 2002). As BAC drinking mediomineral the value found from 150 to 1000 mg/l proceeded to rules of BRAZIL (2004). And to the hypertonic saline waters STD BAC seascapes were standardized levels above 30000 mg/l (BRAZIL, 2005).

For the BAC of hardness used the recommendation of levels between 50 to 500 mg/l (BRAZIL, 2004) and to the BAC sodium above 200 mg/l (BRAZIL, 2000), since their recommendation in diets in front of low concentrations of Na were not found in national legislation as well as any references to the BAC silicon. Were also adopted the minimum values proposed by the GTCAM to the main anions such as BAC sulfate (100 mg/l), chloride (100 mg/l) and fluoride (0.1 mg/l). This work, also selected the minimum value of bioactivity on legislation of Brazil of the BAC when bicarbonate anion prevalent (in STD > 150 mg/l) and combined with the cations Na+,

K^+, Ca^{2+} and Mg^{2+}. Was regarded as predominant, between the salts, one apresentaou combined with baking soda, with quantity greater than 100 mg/l (BRAZIL, 2002).

For the trace elements, tried to follow the logic established by the law of 1945 where in article 35-§1 are related your rankings to content of ions or notable or rare substances prevalent, with values greater than 0.01 mg/l. oligomineral waters adopted as those with fixed waste less than 100 mg/l (BRAZIL, 2002), being selected the trace elements with levels above 0.01 mg/l or even smaller for the rarer up to the limit of detection of 0.005 mg/l as molybdenum, selenium and vanadium (CPRM, 2012).

PART II – BAC (BIOLOGICALLY ACTIVE COMPOUNDS)
CHAPTER 5
ENVIRONMENT, BIoclIMATE AND STREAMFLOW

5.1. Place Settings (L°C)

It is estimated that currently over 20% of diseases and deaths in the world are related to the environment, covering most (85) of the 102 risk categories evaluated by the World Health Organisation, which also considers the physical characteristics or urban and rural environmental factors to human health and community resources critical to cities with quality of life or healthy places (WHO, 2010).

There are geophysical phenomena that we don't yet understand how to influence on our behaviour and health (ecogeophysic). Some of these are: heat, humidity, wind, cosmic rays, static electricity, global solar radiation, atmospheric electricity, natural electric fields by geological action (telluric currents and polarization), sunspots, magnetic fields, natural geomagnetic storms, sudden changes in barometric pressure, gravitational field, thermal fields, ionising radiation arises due to ionization of the natural environment for electromagnetic radiation or corpuscular radiation, natural non-ionizing: ultraviolet (UV), visible light, infrared radiation (IR) and radio frequency (RF), electromagnetic fields of extremely low frequency (ELF), natural radioactivity, heliogeophysic effects (magnetic storms and solar activity) (Komatina, 2004).

Since prehistory are documented specific places considered sacred or associated with extraordinary phenomena beneficial in psychology and human physiology. Despite the pioneering work of Hippocrates have focus for the origin of diseases and their cures us "Airs, waters and Places", the scientific research on the health-related environmental effects took strength only in the 18th century, due to the difficulty of adaptation of Europeans in tropical colonies (Buttimer, 2000).

The environment can be defined as the sum total of the conditions that Act on bodies. A healthy city is one that is continually creating and improving those physical and social environments and expanding community resources which enable people to support each other in performing all the functions of life and in the development of their full potential. Even the urban design has indirect effects on health (Nutbeam, 1989).

In recent decades, large number of works has been produced in the understanding of the positive factors that rural and urban spaces induce to quality of life. Among the explanations:

1.Therapeutic theory of stress recovery through contemplation of natural landscapes or urban settings especially designed;

2.Concept of healing gardens specially designed in the context of leisure, comfort and safety;

3.Theory of restoration of attention with places emphasizing distraction and relaxation through the values of compatibility, fascination, proportion and purpose;

4.Concept of the therapeutic landscapes with sensory properties able to improve the people's physical and mental state (Rao and Kastenholz, 2010). As major elements of the landscape, can influence emotions: color, shape, line, texture, scale and space.

There are many recent research related to green therapies ("greening healthcare") as medicinal alternatives who practice the human integration the natural environment preserved or urban planning and pollution-free, in the pursuit of well-being physical, psychological-emotional, social and spiritual (Irvine and Warber, 2002).

Such salutogenic environments can contribute in the prevention of obesity, type 2 diabetes and cardiovascular problems (Thompson, 2011), create situations of interest to the holistic medicine through symbolic landscapes, sensory aspects of the environment, authenticity of psychosocial factors spatial locations and traditions or recognised research (Williams, 1998).

As measures to evaluate the effects provided to health due to different environments and landscapes are: tests of motor function, behavioral observation, emotional tests, rates of crimes reported by the police, social links with the neighborhood, health self-assessment, frequency of visits to the sick, attention tests, auto-relatos of emotional state, cerebral activity (electroencephalogram), heart rate, interviews/questionnaires, blood pressure, number of days in the hospital after surgery, doses of painkillers during recovery, muscle tension and skin conductance (Velarde et al., 2007).

In the field of medical geography (Buttimer, 2000) there are at least three distinct perspectives of perception:

1.Holistic Interpretations of health and environment (organistion);

2.Standards of behavior of diseases and their possible spatial correlations (formicist) and

3.Diffusion mechanisms, infection and impact (mechanistic).

Currently, it is recognized the important influence that the environment medium can exert on the action of drugs and therapies (Barrett and Gergman, 2008).

In Brazil, are laid down in law the "special areas of interest" as the continuous stretches of the national territory, including its territorial waters, to be preserved and valued in cultural and natural sense, and carry out plans and projects of tourism development (BRAZIL, 1977). Should thus be considered in plans, several of the items described in this paper, such as: I-goods of historic, artistic, archeological value or prehistoric; II-reserves and ecological stations; III-areas for the protection of renewable natural resources; IV-cultural manifestations or ethnological and the places where they occur; V-notable landscapes; VI-localities and natural accidents suited to the home and to the practice of recreational, sporting or leisure; VII-the sources which has become unusable; VIII-localities with special climatic conditions; IX-other to be defined, in accordance with the law.

The sources with miraculous or medicinal waters constitute grounds for health and always inspired the construction of works in their surroundings by appreciation or religious worship. For example, in Ireland, are recognized more than 3000 sacred springs (Foley, 2011). Such buildings culminated in temples and shrines in ancient Greece, aiming at their protection, highlighted or even accentuate their psychological effects in the processes of healing (Thompson, 2011). Some instances of this type are observed in Brazil. (ANNEX TABLE 9.MIRACULOUS FOUNTAINS).

Well after the famous thermal baths of ancient Rome, came the hydromineral European parks and gardens in the eighteenth century and the nature reserves of hot springs and geysers in North America in the nineteenth century (Grossi, 1997). In Russia, and Government researchers plan to constantly so-called places of mineral waters or areas for medicine of the health resorts (Adilov and Rivman, 1983; Adilov and Trebukhovo, 1997). In the Czech Republic, are regulated by law the natural resources of health and localities of SPA (Parliament of the Czech Republic, 2012).

The correlation of interference in the urban environment and strengthening the therapeutic effects took momentum in Europe, being the architecture and infrastructure of the cities of health, fundamental characteristics recorded since the beginning of climatic medicinal practices (Burney-Yeo, 1890). Medical geography professionals currently interpret the potential of health locations, especially considering the existence of hospitals and sanatoriums correlated (Largo-Wight, 2011). Significant decrease in the mortality rate of the elderly who live near urban green areas was demonstrated in the city of Tokyo (Thompson, 2011).

Over time, many communities ended up developing in these neighborhoods, usually creating urban spaces well-preserved and scenic beauty, with gardens, parks, places of rest, therapy centers, establishments with health professionals, accommodation and comfortable residences (Rose, 2012).

The comparative quality of life standards in the spa towns in Brazil, as well as its urban peculiarities are evidenced even today (Andrade, 2012). The historic relationship with the beneficial properties for health or pleasure of the communities that have approved health sources can be evidence of some biologically active content.

The landscape design and the urban conformations are of great importance in a location dedicated to the use of his sources, products and health related environments, in order to increase the attractiveness, satisfaction and mainly support the cure visitors a positive effect on their psychological and physiological structure (Topay and Küçük, 2010).

The crenotherapy has environmental sense not only for their pharmacological/drug effects obtained, but to satisfactory results also participate several internal and external factors, including hydrothermal techniques, adaptation to physical space, emotional sedation, other therapies, hygienic and dietetic procedures. It is very important an individual and group psychotherapy, were the disabled could gather at garden squares or in spring park, making the stay of the sick less insipid in SPA towns (Mourão, 1992).

The differentiation of the localities where the fountains is in relief in Brazil since the 1945 code of mineral waters (article 22), where the hydromineral ranchs are classified by the standing committee of crenology in 3 groups, depending on the quality of its facilities. It is also referred to a draft bill to regulate such standards. Subsequently, law No. 2661 of 1955, define other kinds parameters to these tourism places: thermo-mineral, hydromineral or simply mineral (article 41).

Under these considerations, to evaluate this BAC, are considered the environmental characteristics, economic, historical and tourist of the localities, which have great influence on physiological results obtained by environmental characteristics in the vicinity of thermo-mineral fountains. Thus, a traditionally recognized health resort and with infrastructure due to its classification, will potentiate the benefits of therapeutic practices and their bioactivity.

Normally at balneology traditional locations, they note: urban planning, great hotel, balnearium, history of scientific research (about hydrogeology, geochemistry, sociology, pharmacology and notably medicine), compliance with related lesgilações (mining law procedures, governance strategic planning tourism regarded and official tourist nomenclature), knowledge about natural resources and environments, preservation and carefull evaluations their uses, respect for their past, correlations to improving environmental health and community well-being, integrated possibilities for sustainable economic and professional applications development.

After viewing the georeferenced points on a map with all municipalities of Brazil (ANNEX MAP 3.MUNICIPALITIES OF BRAZIL WITH POLITICAL POINTS OF GEOREFERENCED occURRENCES), the first evidence of a health resort is sought in State legislations and then, in related literature, being found:

L°C	BIBLIOGRAPHY
a1	BRASIL. Estatísticas básicas do turismo. Evolução, dados e fatos. Ministério do Esporte e Turismo - (EMBRATUR) Instituto Brasileiro de Turismo e (IBGE) Instituto Brasileiro de Geografia e Estatística. Brasília/BRA. Mapa. 2002.
a2	BRASIL. Indústria da Água Mineral: Água Mineral. In: Economia Mineral do Brasil, MME/DNPM/Brasilia/BRA.; C9:718-730. 2009.
a3	MOURÃO,B.M. Medicina Hidrológica: Moderna terapeutica das águas minerais e estâncias de cura. PRIMA promotora de informações Ltda Poços de Caldas/BRA. 733 p. 1992.
a3	CAMARGO, R.B.A. Águas Minerais do Brasil – Fontes de Águas Quentes e Frias. Editora Parma, Guarulhos/BRA. 200 p. 1981.
a3	ATHISC (ASSociAÇÃO DE TURISMO HIDROTERMAL DE SANTA CATARINA). Santa Catarina: Turismo Hidrotermal. Informações turísticas de SC/BRA. 11 p. 2012.
a3	LEGISLAÇÕES ESTADUAIS. Santa Catarina:Lei complementar nº 01 de 19 de junho de 1968, Lei complementar nº 2 de 24 de setembro de 1969 e Lei complementar nº 10 de 12 de setembro de 1979; São Paulo:Decreto Legislativo nº 137 de 19 de julho de 1976; Pernambuco:Lei nº 8.912, de 11 de julho de 1994; Bahia:Lei nº 1.451 de 10 de agosto de 1961, lei nº 1.625 de 22 de fevereiro de 1962 e Lei nº 1.698 de 05 de julho de 1962.
S	www.saopaulo.sp.gov.br; www.turminas.mg.gov.br; www.turismo.pr.gov.br; www.sc.gov.br.
a4	FRANGIPANI,A.; CERIANI,C.; FLORA,F.M.; FILHO,M.U.; SIMÕES,R.A.P.; ALVISI,T.C. Termalismo no Brasil. Sociedade Brasileira de Termalismo, Seção de Minas Gerais/BRA. 112 p. 1995.

The conservation status of the deposits, in the middle near and the tradition in use for health, wellness or tourism begin by formatting the possibility of this type of use for these natural resources. Thus, the results were obtained this BAC with the symbol "a", being shown in tourist map 17 of the total 76 selected locations and with subtitles (BRAZIL, 2002) (ANNEX MAP 4.BRAZIL 17 TOURIST THERMAE SPA REGIONS).

The segment "b" matches localities with hydromineral fountains having currently developed tourist activity and structure of attention of your watersheds or aquatic applications (resorts, health resorts, SPAs or hotels), being quite conducive also to SPA and walking to become a health resort. The references used here are detailed in Frost (2004); Al Dulaymie et al. (2011) and apart from personal knowledge or via internet; many of the locations chosen with such characteristics are part of well structured tours that have in their titles the word "water" (BRAZIL, 2007). Your illustration in map with legend is in (ANNEX MAP 5.TOUR of BRAZIL with 22 REGIONS CALLED BY WATERS).

The type "c" relates to sites with basically sources used for the bottling industry, being compiled basically to Queiroz (2004); BRAZIL (2009); SIGHIDRO/DNPM (2012); www.mineralwaters.org.

In the localities of type "d" are stocks of natural resources or attractive features (climate, seaside, sand, mud, monazite, landscape, travel, ecotourism, thermo-mineral fountains, gas, etc.) and with the potential for the development of these types of activities, although not yet to be found or occur so incipient.

This last segment as a criterion of bioactivity of the surroundings of hydromineral sources environmental is added as an allusion to the termalidade of natural waters, by many considered primordial factor in the specialties of "hot springs", so much so that this issue receives generally the name of hydrotherapy. Brazilian tectonic relative stability promotes occurrence of hot springs less abundant compared to countries in belts of fire, although there are some anomalies.

And in addition to the recognized SPA, attention here is focused on places where spring water doesn't necessarily flow very hot, but the temperature is usually higher than the atmosphere of nearby locations. So are termed as hot or for similar terms as warm, caldas or thermae.This variable is identified by ***"e"*** or the variable as ***"I"*** shape of explotation (JAZ) in database SPRINGS BRASIL, representing the "hot springs" (ANNEX MAP 6. MUNICIPALITIES SPRINGS BRASIL GEOREFERENCED).

Have been compiled 82 Brazilian examples, being only 19 at subtropical sites and most are near to urban centres or of recognized tourist resorts. Where: city, district, street, neighborhood, river, river, creek, stream, spring, source, well, pond, waterfall, mountain, hill, fountain, SPA, warm, caldas (ANNEX TABLE 10. LocaLITIES WITH DESIGNATIONS OF HOT WATER IN BRAZIL).

These properties with potential bioactivity according to the current stage of use for grouping of samples in the database (SPRINGS) are briefly presented below:

#	TYPE	n
a	Thermal SPA station recognized, traditional, scheduled by law for scientific research	**76**
b	With a history of exploitation or visited popular tourist SPA installed, recreation center or aquatic natural landscape associated	**35**
c	Seen only bottling industry of mineral water	**112**
d	Potential occurrence with natural therapeutic factor	**163**
e	Location, drainage known hot, warm or thermal spring	**83**

5.2. Climate and Relieves Issues (CLIM/ALT)

The BAC climate is in conjunction with the altitude, because both cause biological activities of obvious influences on medical indications related to thermo-mineral fountains, to the point of the common denomination of the SPA be replaced by hydroclimatism. Environmental geophysical and meteorological changes will directly affect the physiological conditions and can be observed from the standpoint of daily life and to temporary changes (minimum 24 hours).

The main natural properties that cause sensitivity, stimulus and biological reaction are temperature, pressure, humidity, exposure to the Sun's rays, movement and composition of the air. the human thermal comfort, its relations with the average temperature of the skin, the physiology and health has been studied in detail especially between 21 and 29 °C (Liu et al., 2011).

Due to long-term human adaptation and seasonal climate changes daily or short-term are of interest in so-called peptide or reactions "meteopáticas" and can be distinguished in:

.Comfortable, with minor changes in the wind not exceeding 3 m/s, relative humidity at 50%, atmospheric pressure wavering not more than 4 mbar/day and temperature of 14 to 19 °C;

.Relatively comfortable, with amendments on 5 to 8 mbar above atmospheric pressure, 3 to 4°C in temperature, winds above 4 m/s and relative humidity less than 55% or greater than 85% and

.Uncomfortable with strong and abrupt changes daily above 4°C in temperature and atmospheric pressure 8 mbar, even with cyclonic activities and of storms.

These are the therapeutic principles of climotherapy or climatismo, which can be applied or not in conjunction with hydrotherapy (hydroclimatism. The practices are diverse: aerotherapy, heliotherapy, microclimatotherapy (aeroiontherapy ionic spray loaded close to evapotranspiration, waterfalls and sea air or aerophytotherapy in forests) that you can also use the different microclimates of the same mountain, speleotherapy (grottos and caves) and the most well-known thalassotherapy that use coastal marine resources and environments.

The thermal factor influences the organisms in different ways and plays key role in therapeutic mechanisms of mineral waters. The skin is the first and main part affected by heat, where the membrane poikilothermal will adjust the thermal conduction to the innermost parts of the body and the large amount of nerve endings will quickly perceive and react to thermal stimuli. The temperature normally used in hydrotherapeutic treatments is the closest to that of our body (33 to 36°C).

The elements of the related therapeutic influencers, often fundamental in association with healing, municipalities are (Mourão, 1992): a) reaction of adaptation caused by change of physical environment and b) emotional sedation, achieved by new life psychic and new psychological environment.The Crenoclimatism, formerly named Hydroclimatism, defines the joint action, in the sense of greater magnitude, mineromedicinal waters, including sea and of climates, in preventive and curative therapy.

According to Marques da Mata Scheme, the thermal cure has important elements influencing or supporting cast that should be considered, as the reaction of adaptation caused by changes in the physical environment, emotional sedation obtained by new life psychic and new psychological environment, luddism and especially the climatismo (Mourão, 1992).

In spite of this scheme be old, much research has been recently held in this sense and with interesting ramifications as the landscapes and therapeutic pathways, whether rural or urban (Nunes and Sena, 2006; Maniglio, 2007).

The temperature of the environment he's obviously been controlling the human geographical occupation from the early days of its existence, but the heat has been studied in conjunction to the natural chemical elements peculiar to each region, in evolution, conformation and genetic diversity of living beings. This research, called "Ionomics", must also associate temperature differences to the reasoning of evolution and mass extinctions (Salt et al., 2008; Baxter, 2009). As a main sensations related to temperature and moisture are summarized in the table below.

HUMAN PERCEPTION AND THERMAL STRESS LEVEL OR PHYSIOLOGICAL STRESS AT VARIOUS INTERVALS

#	°C	THERMAL PERCEPTION	PHYSIOLOGICAL STRESS
1	**<4**	Very cold	Extreme cold stress
2	**4,1 to 8,0**	Cold	Strong cold stress
3	**8,1 to 13,0**	Fresh	Moderate cold sense
4	**13,1 to 18,0**	Cool slightly	Slight cold sense
5	**18,1 to 23,0**	Comfortable	No thermal stress
6	**23,1 to 29,0**	Warm slightly	Slight heat sense
7	**29,1 to 35,0**	Warm	Moderate heat sense
8	**35,1 to 41,0**	Hot	Strong heat stress
9	**>41,0**	Very hot	Extreme heat stress

Source: Blazejczyk and Matzarakis (2007)

AIR RELATIVE HUMIDITY WITHDRAWAL AND THESE PHYSIOLOGICAL COMFORT RELATION

#	AIR HUMIDITY(%)	COMFORT LEVEL
1	<29	Comfortable
2	30 to 39	Some discomfort

3	40 to 49	Great discomfort, avoid exercise
4	45 to 54	Dangerous
5	>55	Heat stroke imminent

Source: Environment Canada: http//:www.wul.qc.ec.gc.ca/meteo/documentation/Humidex_a.html

PHYSIOLOGICAL TEMPERATURES FEELING BY CLIMATES

TYPE	°C
Very cold	<5
Cold	5 to 22
Fresh	22 to 30
Delightful	30 to 39
Warm	40 to 50
Super hot	50 to 70

Source: Sunwooy et al (2006)

With a relatively higher average temperature than most countries that have information about natural, thermal waters Brazil has shallow water bodies and shallow circulation, also hotter. The relationship between the temperature of some northernmost springs with thermal regulations classification (hipothermal = greater than or equal to 25 °C) deserves its geothermal origin related differentiations (Bertolo, 2006). Nearly 55% Brazilian population lives in tropical climate, 45% in temperate and 5% in semi-arid weather (Place, 2007).

Despite this temperature range be quite pleasant to the touch, great relationship with well-being and even hydrotherapy indications would expect in the northernmost Brazilian parts or above the Tropic of Capricorn (latitude 23° 26' 16″ S), where warm waters would pass unnoticed. However, many springs located in these regions further north, with tropical climates, also arrive to cool in nocturnal periods and certain seasons of the year. In North latitude, according to Masironi and Shaper (1981), the rate of heart attacks doubled every environmental latitude change 15° 00' 00".

Sociomedical factors on climate: altitude are crenotherapy, temperature, atmospheric pressure, humidity, insolation, ventilation, block of the year, ecology, microclimate (Mourão, 1992). The main expected therapeutic effects as climatism practiced at clinics and SPA and the classification of climatism are represented below:

LOCAL BIOKLIME

#	CLIMATE	EFFECT
1	Continents with plains quota between 100 to 500 meters and steppe vegetation, fields or clenched.	Sedative, lowers blood pressure, regulating the nervous system, reduces secretion and suitable for respiratory and the gastrointestinal tract.
2	Continents above 700 meters, with forests.	Sedative, reparative, regenerative, bactericidal, regulates metabolism and nervous system and is indicated for respiratory, hypertension, and rhinitis problems.

Source: Vasylivna (2008)

CLIMATISM CLASSIFICATION

I - Exciting: High altitude (> 1000 m), Mid-altitude (700-1000 m) and Coastal (<80 m).
II - Sedatives: Continental lowland (100-500 m), Field or Surface (50-100 m) and Mountains (> 1560 m). **Distinguished three types:**
A. Does not matter: it is one in which the individual is only transferred to an equal to his normal life climate, only hygienically improved. It is not exposed to new stimuli, just go to the healthier environment, which promptly improves their physiological conditions.
B. Economy or renting: is one in which the individual moves to a less stimulating environment in which he lives. You will find an atmosphere where their energies will be spared. This is the case of a resident of cold, very dry and windy place where the temperature and the barometric pressure does not suffer violent or sudden changes.
C. Assets: one in which the body, in many climates, is exposed to new stimuli, which excite the organic functions. There are two subdivisions of active weather: the sea and the high altitudes.

Sources: Bardet, (1947); Mourão (1992); Frangipani et al (1995)

Stimulus and rest are key elements of climotherapy and their bioactive dosages are known 4 methods: ordinary climate, rest on fresh air, air bath and heliotherapy. The climatotherapy has 3 zones of stimuli with intensities well differentiated: marine or coastal, dry or low humidity and hilly or alpine (Schuh, 1993).

The stimulus can be due to factors: inorganic (heat, humidity, wind, light, radiation, cosmic rays, magnetic field, static electricity or trace elements in the soil, food and water) or socio-cultural still organic. Some believe that a disease can occur only when two of these factors coincide in time and space (Komatina, 2004).

The bioklime of tropical cities can be differentiated into 4 basic types (Jauregui, 1991):

.Low latitude (mainly coastal or lowland), where sweltering conditions prevail throughout the year;

.Middle tropical (wet/dry), where heat prevails for several months, especially before the rainy season;

.The tropical highlands, where the bioclime is tempered by the altitude and

.Dry bioclime subtropical/desertic characterized by conditions of stress caused by the heat in summer and cold in winter; this type is analogous to the bioclima of average altitude, although more stressful in the summer.

This bioclimatic methodology can only be used as an independent element of a cure for health if it is able to relieve or stimulate the body's functions. Depending on the therapeutic goal, air pollution should be minimized and the patient is exposed to the stimulus of a family climate. Therefore, climate information are collected to create a portrait of healthy and unhealthy aspects of the local climate.

The report on bioclimates underlies a better therapeutic treatment, using climatic stimuli as independent elements of climatic health cure. A bioclimatic assessment of the climate must be conducted on the basis of beneficial factors, stimulating and encouraging. Special emphasis should be on heat resistance of annual cycle stimuli and influence of heat, considering the overnight cooling and radiation conditions. The intensity and effects of local wind systems also play an important role in the evaluation. If the weather is used for the therapeutic treatment in spas, climatic climate detalhadao more analysis is required (ESPA, 2006).

The Köppen climate classification system is the worldwide most widely used, with categories based on monthly and annual averages for temperature and precipitation, being recognised five main types, designated by a uppercase letter (Pidwirny, 2006):

A. Moist tropical climates every month with average temperatures > 18°C

B. Dry climates with poor rainfall during most of the year

C. Humid climates with mild winters average latitude

D. Humid climates with cold winters average latitude

E. Polar climates with winters and cold summers.

It is also considered relevant highlight health sources with not too common climates anywhere else in the world like:

.Amazonian Equatorial (humid hot all year round and with forest evapotranspiration), examples like Itaituba, Monte Alegre, Marajó/PA, Rio Branco/AC and Morro dos Seis Lagos/AM.

.Equatorial ocean: Fernando de Noronha/PE.

.Semi-arid continental: Cipó, Itapicurú, Tucano/BA and São João do Rio do Peixe/PE..Semi-arid coastal Mossoró/RN.

In Brazil, the fountains and SPA towns that are near or South of the Tropic of Capricorn usually have coldest winter, therefore, can be differentiated from those that have less stringent winters at this latitude (Mourão, personal information), such as: Águas de São Pedro, Águas de Santa Bárbara, Ibirá, Presidente Prudente, Paraguaçu Paulista and São José do Rio Preto/SP.

The climates for each occurrence of the mineral fountains database SPRINGS BRASIL were obtained by overlapping the points on the map of Köeppen climates, adapted with greater detail digital (Sparovek et al., 2007) (ANNEX MAP 7.CLIMATIC OCCURRENCES SPRINGS BRASIL). Some of this information are summarized in the tables below:

CLIMATES (Köeppen-Geiger) WERE SPRINGS BRASIL PLOTTED

(N= amount in this classification)

SIMB	CLASSIFICATION	FEATURES	N
Af(am)	Amazon forest	Hot and humid all year equatorial	**7**
Af(at)	Atlantic	Hot and humid all year	**10**
Am	Tropical humid	Hot and humid, with small dry period	**17**
Aw	Savannah / Cerrado	Tropical with dry winter	**128**
As	Tropical	Dry summer	**16**
BSh	Caatinga	Hot and semi-arid	**37**
Cwb		Dry winter and moderate summer	**23**
Cwa	Altitude tropical	Dry winter and warm summer	**77**
Cfa	Continental sub-tropical	Moist all year and warm summer	**98**
Cfb	Oceanic sub-tropical	Moist all year and summer moderate	**50**

Ocean Tropical	Tropical oceanic	**1**

Source: adapt. Sparovek et al. (2007)

CLIMATE BAC STIMULATING IN LATITUDE + ALTITUDE

#	BAC	SIMBOL	PROPERTIES	N
6	Altitude Mountainous	**MONT**	>1560 *m	**1**
7	High altitude	**ALT**	>1000 m	**12**
8	Low Altitude and Coastal Environment	**TALASSO**	<80 m (Coast)	**41**
9	Average altitude with Extreme Moisture (Dry or Wet)	**EQUAT/SAV/ARID**	100 to 300 m +**UTC<5% ou UTC>50%	**26**
10	Medium to High Altitude and Latitude North (Tropical Soft)	**TROPICSHOK**	>500 m +North>15 00 00°***	**21**
11	High Altitude and Latitude South (Temperate / Cool)	**CAPRICOLD**	>700 m +South<232616°	**33**

**m=meters above sea level. **UTC=air relative humidity. ***latitude grade.*

5.3. Discharge Bulk (flow)

Surface water resources are above one million km3 of liquid water stored in the continents, and the aquifers are 30 times more voluminous than the lakes and 3000 times rivers. However, are virtually isolated, with restricted communications to external environment and scarce natural discharge points in the form of springs (USGS, 2012).

The rising water flow occurs due to saturation underground, gravity or hydrostatic pressure (Krezic, 2010). Usually be punctual and not very common in nature, and may also flow heat, gases emanated, dissolved gases, radioactivity, colloids, salts, ions (electrolytes) and micro-organisms, derived from hydrological cycle recent or old.

Compared to other incidents surface water as streams, creeks or rivers, usually smaller and larger have certificates in dynamic and physico-chemical aspects (flow, turbidity, temperature, pH). In their emergency points, can form small ponds ("seepage springs"), swamps, pools, lakes, streams, rivers or streams large submarines.

The discharge of a spring may indicate environmental conditions, surface and groundwater, and its physical and chemical properties quite sensitive to human impacts, as well as the natural regional changes.

Their special features and unusual produce microenvironments with morphology, physical chemistry and differentiated ecosystems. His study has aided in the hydrological knowledge, hydrogeological, geological, biological, anthropological and regional environmental (mango, 2001).Water flows from hydromineral fountains come from groundwater naturally bursts as the sources or reached by drilling wells with pumping. Some wells may be jorrantes, i.e. with spontaneous flow to the surface.

The quality of A source and its state of preservation is typically evaluated through the constancy of features like (Mourão, 1992): a) in emergency flow without change in the seasons and weather changes; b) termalidade independent of the climatic variations; c) physico-chemical constancy; d) analytical content of cations and anions durable; e) presence of mineral elements in quantities unchanged endorsable, verified by microespectral analysis; f) fixed radioactivity; g) form of outcrop.

In Brazil, in physico-chemical reports for legal registration of health activities, are required some analysis "on the spot", such as: flow rate, air and water temperature, pH, conductivity and dissolved radon gas. The classifications relating to termalidade and radioactivity should be disclosed following the phrase "at source".

Some authors explain the importance of this exhibition in the occurrence by ionization States that occur in these environments, the joint and the gas fumes undesirable changes that occur later in the waters due to an abrupt change in the increase in speed of dynamic molecules upon exiting the confined space in which they were submerged for a long period, the influence of light, biological actions, hydrolysis of chemical compounds, volatilization of others, absorbing external elements and instability at pH (Bellissent-Funel et al., 1993).

Spontaneous discharges are also valued as showers or whirlpool tub. Bioactive interests relates to the contribution and constant renewal of resources as well as the multiplication potential physical properties such as temperature and radioactivity that accumulate in obstacles like the human body, while the waters follow their streams (Rodriguez, 2000).

The term seaside power means the ability of immersion baths per day in tubs with a capacity of 333 litres on average. Your calculation for the total of daily baths is made by total flow in litres per day divided by 333 litres (Andrade, Jr., 1926). Traditional Feng Shui philosophy relates to the movement of water sources to the point of being produced miniatures for domestic use.

In some countries also called as "generosity", the measure of flow influence on economic attractiveness ratings for the installation of bathing projects, SPA, health resorts and recreation centers. In Poland, the region of SPAs with smaller average water discharge, still harnessed, has flow of 3240 litres/h (Kepinska, 2002). In geo-economic study of the main thermal springs of Malaysia, considered high discharges have flow exceeding 3600 l/h (Samsudin et al., 1997).

In estimating potential places for installation of ventures in hydrotherapy in Iraq, the headwaters flow rates are primarily differentiated and detailed as: sustainable high flow, medium flow, sustainable low flow and stagnant. One of the considered sustainable, the average discharge is 144000 l/h (Al Dulaymie et al., 2011). In work of regional Hydrochemistry in the province of Limpopo (South Africa), 83 were observed hot springs and the flow of the most famous in Warmbaths is 8000 l/h (Olivier et al., 2008).

To calculate the average regional installed energy capacity in these applications classified as geothermal direct use, which is estimated to exist in all countries, experts tend to ignore or lower consumption springs to 10800 l/h (Lund et al., 2010).

Within the design initially described the potential bioactivity related to spontaneous water deposits and in special environments of natural springs, the minimum threshold value for this selection (Mflow) is of 4000 l/h; being based on the only national legislation where such quantification is found in article 3 thereof-II-paragraph 4 (São Paulo, 1972). As of the best-known classifications is presented in the following table the Meinzer, next to database instances SPRINGS BRASIL.

Classificação de fontes hidrominerais por Magnitude (MAG), diante da taxa média de descarga em l/h (Scott et al., 2004).

MAG	Descarga (l/h)	N	n	j
1	>10183320	0	0	0
2	1018332 a 10183320	5	5	0
3	101833 a 1018332	36	14	13
4	22260 a 101833	69	26	14
5	2226 a 22260	193	118	17
6	226 a 2226	86	58	5
7	50 a 226	11	8	2
8	<50	2	1	1
T		402	230	52

MAG= ordem de magnitude, N= quantidade de ocorrências no SPRING BRASIL, n= nascentes na magnitude, j= poços jorrantes na magnitude, T= total.

In the U.S. are quotes from springs with discharge above the first magnitude (= 33 Florida, Idaho = 11 = Missouri 10, Arkansas = 10) and France Vaucluse Fountain. In the second magnitude in the U.S. are its most caudal springs (Virginia = 13, = 4 Tennessee - USGS, 2012) and in Spain with an inventory of 17,000 springs only 10 this magnitude (Perez, 1996).

MAG = order of magnitude, N = number of occurrences in BRAZIL, n = SPRING sources in magnitude, j = jorrantes wells in magnitude, T = total.

In the USA there are quotes from sources flush above the first magnitude (= Florida 33 = Idaho 11, Missouri 10, Arkansas == 10) and Vaucluse in France the Source. In the second magnitude in the U.S. are its most caudal springs (= 13 Virginia, Tennessee = 4-USGS, 2012) and in Spain with an inventory of 17,000 just 10 sources in this magnitude (Perez, 1996).

CHAPTER 6
TEMPERATURES

The heat on planet Earth comes from the primordial radiation and Sun's current total of impacts with meteorites and natural phenomena of its inner layers. The temperatures of the Earth's surface, the heat from the interior corresponds to a very small part when compared to heating by solar irradiation based weather phenomena, oceanic, continental, hydrological and biological. The global annual average temperature of surface is of 15 °C (Foulger, 2007).

Solar energy has also been quite active in the conformation of the land structure in its early days, currently its heat reaches a maximum of 250 metres in underground layers of tropical and arid regions 500 meters deep in the hydrosphere (Aguilar et al., 2004). Also notes that in ice ages, the cold came to affect the global geothermal flow by up to 2000 meters deep and polar systems still cools small portions of the crust. The incidence of sunlight in certain rock types may affect regional ecosystems and microclimates (Kearney, 2002).

There are many hypotheses about the absorption of solar energy and geothermal by shallow clay layers and release of energy of hidrogeoquímicos processes, such as the energy balance of the volatile and aqueous solutions (Shvartsev, 2008).

However, solar energy currently has little influence on underground heat, with power of penetration in water up to 300 meters. The natural heating of the surface from its interior is called geothermal energy.

This geothermal heat is produced mainly in the lower mantle, but can pass through the combination of various mechanisms (Anderson, 1989; Muffler, 1993): 1. decay of long-lived radioactive elements, particularly isotopes of uranium, thorium and potassium; 2. vertical Segregation of current generating layers: core, mantle and crust; 3. gravitational energy in the early stages of accretion; 4. adiabatic Compression; 5. friction between tectonic plates and fault zones; 6. mantélicos Flows in feathers and magmatic processes; 7. chemical Differentiation laminate; 8. Geomagnetism; 9. the rotational energy Dissipation, with the Earth's rotation rate decreasing in time scale; 10. conversion of kinetic energy into heat from primordial matter of the origin of the planet 4.5 billion years ago.In more recent eras, the radioactive decay of originally segregated crustal material from the mantle is the mechanism that produces the vast majority of this heat, containing as its main: potassium (151.0 ppm), thorium (0.0766 ppm) and uranium (0.0197 ppm). The highest average capacity of 2.5 x 10-6 W/m3 due to the granite because of the higher levels of these elements: potassium (3.6%), thorium (16 ppm) and uranium (3.9 ppm) (Reed, 1983).

The estimated temperature in the Earth's core is more than 4500 °C, diminishing gradually towards the surface, being of 1500 to 1200 °C in the mantle and 1000 to 200 °C at the base of the continental crust. The average geothermal gradient in the crust is between 25 and 30°C/km. In volcanic regions, can reach 100°C/km and in ancient cratons less than 15°C/km, descending at great depths (Shibaki and Beck, 2003).

Three variables control the temperature in the lithosphere: superficial thermal flow medium, average crustal heat production and vertical variations in the production, composition, structure and related geological dynamics. Thermal diffusion mechanisms include the loss of heat from the core to the mantle, the feathers of convection, the heat loss of the mantle to the crust and plate tectonics. Half of the heat comes from the mantle and the other half comes from the radioactive decay in continental crust (0.9 µcal/cm2/s) added to the dynamics of plaques on old oceanic crust (Hofmeister and Criss, 2003).

The mechanism of convection is responsible for most of the geothermal source dynamics from the planet and still predominates in the mantle, in the form of passive transport, offsets by density differences, volatile and pressurized streams of fluid masses. In higher layers, thermal convective flows are associated to regional side or horizontal movements of the plates and volcanic processes litosféricas (Lund, 2007).

The unusual approach of underground heat can occur due to greater regional heat flux of deep crustal thinning, origin, characteristics of conductive transport in solid, fluid, thermal convection sections connections, ability to spot exchanges and circulation of fluids (Drury, 1987; Foulger, 2007).

In regions of abnormally high heat flow, thermal convection dominates the groundwater environment in the crust and permeable systems originates in which hot water approaches the surface by means of hot flow upward. Are generally derived from meteoric waters saturated continental air to penetrate the crust up to occupy the cooling magmatic systems level in depths greater than 5 km. similar process occurs in coastal systems and of oceanic islands with additional mixing of ocean water (Henley, 1983). A hydrothermal system can bring water to the surface, in the form of geysers, hot springs and wells jorrantes.

Configure an anomaly and characterize a geothermal system is part of the geological survey. Despite the great diversity of models in general classifications separate two large groups: (a) magmatic activity, which determine the approach of heat to the surface and (b) amagmáticas activities, which cause rising of underground heat through natural fluids, co-production of other substances or artificial circulation of fluids (Sanyal, 2005).

Recent magmatic activities, with less than a million years focus on three types of geological environments: subduction zones of the "belt of Fire of the Pacific"; areas of tension in "rift valleys or mid-ocean chains" and "hot spots" or fixed locations of the mantle that continually bring magma to the surface by volcanoes, displaced by the movement of plates (Henley and Ellis, 1983). In magmatic events less than 100 extinct millions of years may also exist geothermal anomalies, due to the slow recovery of the thermodynamic equilibrium regional major scales of time and depth as the thickness of the lithosphere in the location and dimensions of the occurrence (Kaminski and Jaupart, 2000).

Magmatic or not magmatic anomalies may be related to high-porosity rock under hydrostatic pressure, thermal blanketing or isolation of deep rocks for thick overlay of rocks like shale, whose thermal conductivity is low, high-porosity rocks at much higher pressures for hydrostatic ("geopressurized"), heating of superficial rock by retard decomposition mean concentration of radioactive elements (perhaps augmented by thermal blanketing) hot, rock formations, but droughts and low porosity ("Hot Dry Rock-HDR"), neotectonic activity, crustal thickness and thinning mainly by circulation with vertical amplitude of hydrothermal fluids high-deep circulation of meteoric waters along faults and fractures (Muffler, 1976; Wright, 1998; Williams et al., 2011).

6.1. Hydrothermalism

The main source of heat into surface waters is the Sun and the intensity of its effect falls sharply with depth, to the point of heating to more than one metre deep practically be null. Thus, the temperature decreases the deeper portion of the reservoir, being that many feet below the surface of the water cooling is slow to the point of having almost the same shallow temperature (Ernst et al., 1986).

However, on the layer named "Termocline or Metalimnum" the temperature drops quickly and precisely where the water density also increases. After several metres deep, this layer ends and continues decrementing in a manner much more slow and gradual. The zone of separation higher than the "Termocline" is "Epilirnniurn" and the lower "Hypolimniurn", all of which can occur only in larger and deeper water reservoirs. In warmer climates, this phenomenon should be more intense (Aguilar et al., 2004).

The large bodies of water — especially the oceans, participating significantly in the temperature control of the entire Earth's surface. Surface waters tend to be in temperatures approaching at the same atmospheric region (Sars, 2010). Some of these data are summarized in the following table:

PARÂMETROS DAS ÁGUAS NATURAIS SUPERFICIAIS

AMBIENTE	(°C)	(ATM-bar)	(g/l)
oceano	-2 a 40	0 a 1000	10 a 80
Lago	0 a 40	0 a 50	0,2 a 600
Lagoa	0 a 40	0 a 1	0,1 a 170
Mar	0 a 40	0 a 10	10 a 700
Fonte Termal	0 a 400	0 a 500	70 a 600

Fonte: Millero (1985)

For being the most common fluid near the Earth's surface, the water becomes a fundamental element and almost always present in the generation or forms of utilisation of geothermal anomalies; both magmatic reservoirs as amagmáticos are usually associated with shallow or deep natural circulation of water, called hydrothermal systems.

In the atmosphere, the water temperature follows the middle one. In groundwater, the heat is quite variable, depending on the particular depth of layers where they circulate and water flow rate. At greater depths, temperature increases and will oscillate a lot less. It is estimated that the average groundwater temperature is between 5 and 13°C in hot springs in excess of 25°C and can reach up to 200 °C geysers. The groundwater heat stems mainly from the geothermal gradient, through thermal flow of his movement, and, secondarily, can originate due to volcanism, cooling of magma and physical-chemical reactions (Patterson and Runnells, 1999).

The groundwater temperature is quite uniform throughout the year, when compared to superficial. Shallow aquifers, with depth of insulation above 10 metres, float your temperatures in less than 0.5 °C/ano and are used in some places as cooling source in human activities. However, below 20 meters begin to suffer influence of geothermal gradient and usually have temperatures above 2°C average annual temperate climate (Custodio and Llamas, 1983). Despite the influence of temperature on other large parameters, the thermal amplitude in groundwater is usually low (between 1 and 2°C) and is independent of the atmospheric temperature, except in shallow free aquifers, where the temperature is slightly higher than the surface.

The temperature of the waters to recharge shallow and artificial injection via Wells also influences the heat of their aquifers, substantially increasing how much greater depth and in areas of soil, regolith or rock unsaturated. Other important factors in the study of this balance are: capacity and thermal conductivity of solids and fluids involved, speed and volume of the horizontal and vertical flow, shallow geothermal gradient and heat, secondarily, friction between water and porous medium, expansion of water, chemical reactions, biological activities, radioactivity (Stevens et al., 1978).

The main factors that can influence the temperature of water in springs are: long and shallow display area, surrounding vegetation cover, geographical coordinates, rainfall, recharge area features, depth, velocity of circulation and climate oscillations (Lund, 2000; Beer et al., 2007).

The amount of dissolved salts in water increases with temperature, due to mineral dissolution reactions and ion exchange. In addition, causes also increase the measured values of electrical conductivity, due to the greater quantity of dissolved salts and pH, due to dissolution of gases and salts in the water. In contrast, favors the decrease of the concentration of dissolved oxygen in the water, which is commonly consumed in various reactions (Freeze and Cherry, 1979; Feitosa and Manoel Filho, 1997).

The origin and evolution of life are closely related to the ambient temperature and especially water. The physico-chemical properties of the atmosphere, oceans and hydrothermal vents are controlled mainly by temperature and such conditions allow life on the planet. In addition to the current ecosystems, the physiological balance friendly heat is also key variable in paleontological and archaeological processes.

With respect to aquatic, biochemistry heat influences on speed of biological activity, on oxygen absorption and precipitation of compounds. Under this point of view, in the case of groundwater, the temperature has direct influence on the physico-chemical properties (concentration and total conductivity, pH, gases, density, etc.), because its variation can affect the natural reactions that occur in geological medium, changing geochemical and biological characteristics of water. The difference in density of water between 20 and 30 °C is much larger than between 10 and 20 °C (Sadanobu, 2006).

The thermal factor influences the organisms in different ways and plays key role in therapeutic mechanisms of mineral waters. The skin is the first and main part affected by heat, where the membrane poikilothermal will adjust the thermal conduction to the innermost parts of the body and the large amount of nerve endings will quickly perceive and react to thermal stimuli. The temperature normally used in hydrotherapeutic treatments is the closest to our body: 33 to 36°C (Ashrae, 1999).

The main techniques hidroterápicas thermal (in topical treatments and temporary) are: thermotherapy (above 37 °C) and cryotherapy (between 15 and 35°C), with alternating temperatures and exercises in the aquatic environment. Among the benefits observed are: Fibromyalgy, childbirth, newborn care, insect bites, low back pain, arthrosis, arthritis, rheumatism, sores, insomnia, upper respiratory tract infections, pathology-neuron, relaxation, stress, fever, muscular pains (Vilà, 2008).

Both cold as hot, at the beginning, there are vasoconstriction and vasodilation, (Dimitrios et al., 2007). Some international differences: only the Japanese use temperature up to 48°C in the USA until 42 °C are warm and hot above this, in Eastern European countries are cold below 20°C, warm up to 39°C and above 40°C hot. In Spain, is considered cold below 18°C and above 39°C hot. Some types of baths, such as Turkish, Japanese and Russian are very superior. The following compilations of international classifications.

CLASSIFICAÇÕES INTERNACIONAIS

°C	RUS	BUL	ESP	ITA	Mundo	FRA	JAP	ARG	CUB	BRA
cold	4a20	<20	<20	<20		<20	<25	0a20		<25
term	20a35	20a34	29a30	20a30	<35	20a30	25a34	21a30	<25	25a36
ISTM	35a42	34a37	30a50	30a40	35a37	30a50	34a42	31a40	25a28	36a38
HIPT	42a100	37a50	>50	>40	>37	50a100	>42	>40	>29	>38
muito		50a90								
ferv	>100	>90				>100				

Fonte: (adaptado Fagundo et al., 2001)

Hydrotherapy through immersion in water, or balneotherapy, suffers great influence before the distinct ranges of heat, as well as on-call time, composition of water and hydraulic pressure, for example, affects the respiration and the activity of the cardiac nerve completely different way automatic in the range between 25 to 34 °C than above 38 °C (Kishino and Matsuda, 1998).

The change in hemodynamics and heart rate variability also gives as the different temperature of the baths (Kataoka and Yoshida, 2005). The title of the baths according to the temperatures stated in the table below:

DENOMINAÇÕES GENÉRICAS QUANTO A TEMPERATURA DAS ÁGUAS

°C	10 - 15	15 - 30	30 - 34	33 - 35	36 - 38	38 - 40	> 40
Água	Gelada	Fria	Fresca	Indiferente	Quente	Muito Quente	Escaldante

Fonte: Lund (2000)

Some techniques enshrined in balneotherapy have different temperatures to air, to water and immersion time, as shown in the tables below:

APLICAÇÕES HIDROTERÁPICAS

BANHO	°C	DURAÇÃO	RECOMENDAÇÃO
Frio	15 a 20	5 a 30 segundos (contraste)	Fechar poros, controle oleosidade, flacidez, intestino preso, hemorragia
Morno	22 a 33		Limpeza
Indiferente	33 a 36	10 a 30 minutos ou +	Sedativa
Tépido	35 a 36		Sedativa

Quente	37 a 39	10 a 20 minutos (máx)	Relaxamento
Muito Quente	39,5 a 42	2 a 5 minutos	Estimulante
Alternado (*pavaex*)	15 a 20 (frio) 38 a 42 (calor)	10 a 30 segundos 3 a 5 minutos	
Parcial	38 a 45	10 a 20 minutos	Analgésica

Fonte: Mourão (1992)

CONDIÇÕES RECOMENDADAS PARA PISCINA "NATATORIUM"

TIPO PISCINA	°C AR	°C ÁGUA	% UMIDADE AR
Recreacional	24-29	24-29	50-60
Terapêutica	27-29	29-35	50-60
Competição	26-29	24-28	50-60
Mergulho	27-29	27-32	50-60
Banheira/SPA	27-29	36-40	50-60

Fonte: WHO (2006)

When necessary, artificial warming of the water, however, this procedure can change some natural characteristics such as dissolved gases, ionic correlations, microbiology, Colloid, organic matter, pH and density, as well as other peculiarities related to the Mpemba effect, as the fastest cooling, mainly by not be influencing the natural composition of the water in their origins and long exposure in the hydrological cycle (O'Hare et al., 1985).

In this paper, the different temperature values according to the potentially bioactive applications compiled on bibliography are described below.

#	BAC	Symbol	°C
16	TEMPERATURE GEOTHERMAL	**geot**	**>57**
17	TEMPERATURE HYPERTHERMAL	**HIPT**	**>38.5**
18	TEMPERATURE ISOTHERMAL (meso)	**ISTM**	**33 a 38.4**
19	TEMPERATURE HOT(hipo)	**term**	**25.1 a 32.9**
20	TEMPERATURE TEPID	**warm**	**18.2 a 25**
21	TEMPERATURE COOL	**cold**	**<18.1**

6.2. Caloric Animation (hot spring)

The renewed heat continuously is often used in the calculations of the geothermal potential of a region, basically the product of fluid temperature in time (°C/hour, for example).Were selected as potential BAC, only documented samples as sources or to a maximum 30 m depth. The thermal waters above 25.1°C these value were selected.

The resource base of geothermal energy Brazilian total is estimated at 2.4 x 1025 J, being half of the fraction accessible (5.2 x 1022) present in areas of sedimentary basins. Several geothermal systems are small businesses with temperatures less than 90 °C. The total capacity of geothermal systems with economic exploitation is estimated at 362 MWt (thermal mega watt) and the annual energy use 6,536 TJ (Tera Joules).

To estimate the average annual geothermal energy for potential use of the springs if adopted (Kepinska, 2002): TJ/year = average discharge (l/s) x (water temperature – temperature of the ambient air expressed as an annual average) (°C) X 0.1319.

Since Brazil's annual average temperature is estimated at 25 °C, hypothermal water only (= or > to 25.1 °C) and with spontaneous flows by springs or natural wells spurts were then used for the calculation.

If you obtained the value of spontaneous energy total direct geothermal baths for 226 samples with data from the SPRINGS BRAZIL > 2568.3 TJ/year.

For the 48 classified as potential BAC in power hidrogeotermal, 1701.7 TJ/year, with 1/3 of the total amount for this geothermal direct use recently calculated for the country of 6530.0 TJ/year (Lund et al., 2010). In Poland, baths and pools of 55.2 TJ/year provide a total of 281.05 MWt or 1501.1 TJ/year.

6.3. Geothermal Potential (geot)

For the high heat considered in this component, beneficial relations are not related to contacts through ingestion or physiological baths, but in the same way as in the BAC of the localities, are interesting possible applications to the comfort, well being and performance of all the related activities.

Geothermal resources can be used in a variety of ways and the most common worldwide occurs by pumping or even natural flow of warm water that circulate for heating of environments, hydrothermal ventures (water parks, hotels, spas or SPA) or production processes in General, and can save up to 60% electricity consumption compared to traditional air conditioning systems. More recently, through this mechanism can also direct use of electricity through technology involving binary plant (Rybach, 2007).

An example where this has been implemented through the lowest temperature of its waters is in the SPA Resort of Chena in Alaska/USA (temperature of 74°C) (Lund, 1981). However, in more recent work noted that by increasing the laminar flow and pressure due to the drilling of new wells, as well as by the increased technology in the system; being possible to generate electric power for temperatras of 57 °C (Erkan et al., 2008) and this will be the minimum value here adopted (geot).

6.4. Hyperthermal (HIPT)

The highest temperature found for use in hot water therapy is related to their intake to 50 °C, where clinical trial of 2 days and 12 patients showed positive effects for cases of functional disorders of the esophagus or full-blown achalasia (Ren et al., 2012).

Immersion in water at 40 °C (regarded as decidedly hot) has a stimulating effect initially, followed by a body muscle relaxation response. After a few minutes of exposure, there is beginning of cutaneous sensation uncomfortable. And this temperature (or up to 44°C) is used in partial contrast baths by Sitz technique, as well as the Vichy showers to 50 °C, can destroy the mucous membranes (with exception of vaginal) and produce damage to the skin in a few minutes. Also at this temperature, contrasts are made of short exposure (cold) by the technique of Scotch douche (Bergel and Williams, 1998).

Research performed with 5000 residents of Shizuoka (Japan) with more than 20 years of age, revealed that 23% uses the practice Onsen with immersion baths at temperatures above 40°C, which claim to increase of health condiões (Goto et al., 2012).

Comparative research was conducted among two groups of Japanese participants 617, distinguished by more or less 7 immersion baths weekly and evaluated through measures of pressure, blood tests and personal accounts about the quality of health and sleep. Positive health indicators were observed in the population that more frequented these baths, whose temperatures are between 40 and 42 °C (Hayasaka et al., 2010). Such temperatures are also confirmed in a study that recommends keeping the air of the environments of these baths at least 25 °C (Hashiguchi et al., 2002).

Study with volunteers in immersion baths under various temperatures showed that the most significant increase in the volume of lung capillary blood occurs at 40 °C, as well as respiratory muscle activity and is not recommended for pregnancy (Choukroun et al., 1983; Choukroun et al., 1990).

Hemodynamic analysis with 9 volunteers above 75 years of age compared with same group of 9 young people showed that soaking baths above 40 °C, after 4 minutes, can decrease sympathetic tone and potentiate the hypotensive syncope in the elderly (Nagasawa et al., 2001). Its use is crenoterápico possible after the fourth section of bath (Mourão, 1992).

Baths in warm waters above 40 °C can leave skin more susceptible to irritation caused by soaps and shampoos than when the 20 °C (Ohlenschlaeger et al., 1996).

There is a concordance that immersion baths at this temperature decrease pulmonary capillary pressure and atrial besides increasing the cardiac output and stroke volume. Thus, it was decided that the temperature for potential bioactivity hipertermal (MHIPT) is 38.5 °C. This value is similar to the policies of countries with very cold climates and where the population has no habit of hyperthermal baths as in Japan. Follow also the recommendation of the medical practices of physical rehabilitation of the United States (Becker, 1994, 2009).

The evaluation on 8 patients with diabetes melittus where joined physical activities and baths with partial immersions hyperthermal (over 38.5 °C) during 3 weeks showed beneficial increase blood flow to skeletal muscles and 18% reduction in insulin requirements (Hooper, 1999).

6.5. Isothermal (ISTM)

In also known as neutral bath (temperature closer to the human body of 33 °C), occur few physiological changes and sensory indifference as to hot or cold (Bergel and Williams, 1998). Being suitable for hygiene, cleaning and underwater exercises, this is water temperature reference here as minimum value of potential bioactivity isotermal (MISTM).

In assessing the effects on the distribution of body fluids caused by immersion baths under the temperature of 18.1°C (cold) and 33.3 °C (neutral), were observed during 30 days, 7 volunteers for each temperature. As a result, there has been a significant greater hemodilution on neutral temperature, which is similar to the minimum value (MISTM) referred to (Stocks et al., 2004).

Randomized clinical trial proved to be the temperature of 37 °C ideal for water colonoscópicas (Radaelli et al., 2010). The effects related to partial immersion baths sitting, with a temperature of 35°C are described through analyses in 8 patients, who have had significant increases diuresis, hemodilution and cardiac index (O'Hare et al., 1985).

The maximum value of 38.5 °C (MISTM) corresponds to the highest temperature described as warm at medical practices recommendation for physical rehabilitation of the United States, and the minimum of 33.5°C is the parameter of the dips close to neutral here selected. This interval can be considered suitable for long exposure, performing aquatic exercises and safely for therapeutic effects, even for hypertensive patients. As a reference, the cardiac output in immersions of 33 °C is 30% and the 39 °C rises to 121% (Becker, 1994, 2009).

At temperatures much above 35°C occurs vasodilation and cutaneous circulation heating, raising the body temperature to heat the water. And above 38.5°C, for people not accustomed, discomfort may occur, palpitations, choking, tachycardia, drop in blood pressure and plasma volume reduction (Franchimont et al., 1983).

Through clinical evaluation in 63 patients with osteoartrites problems on his hands, were compared during two weeks of temperatures located with baths 36 and 38°C in the water of the SPA Gunaras health (Hungary), where he obtained the best results in warmer (Horvath et al., 2011).

Among the most common applications are balneotherapy the osteoartrites treatments. On work begun by compiling this thematic bibliographies 226 performed randomized clinical trial on nine distinct balneotherapy practices by periods of treatments and baths, temperatures being only the focus for patients with knee oesteoartrites. The therapeutic results, related to biological activities by termalidades of all waters (between 34 and 38°C), are stimulants and deserve further research (Harzy et al., 2009).

Through a bath the 34.5°C was confirmed the hypothesis that a gradual increase of blood volume total would be accompanied by a decrease in vascular resistance gradually also skeletal muscle and subcutaneous, forearm caused by vasoconstriction and neuroendocrine activities (Gabrielsen et al., 2000).

Isotermais baths, that here also include the Brazilian classification of meso-thermal, are especially interesting to health when used in own sources and especially in running water, due to the preservation of all the physico-chemical properties of your original suburban train balance.

6.6. Hipothermal or Hot (term)

This temperature range lies within the recommendation for physical rehabilitation medical practices of the United States, as cold waters (26 to 29.5°C), being recommended for vigorous physical activities, aquatic exercises for patients with multiple sclerosis and pregnant.

The most competitive public swimming pools to the public or elderly rehabilitation operates with temperatures between 27 and 29°C, due to the lower average activity of these (Becker, 1994, 2009).

In comparison on the physiological effects that immersion baths can cause in front of 3 different temperatures: 32; 20 and 14 °C; vital functions were evaluated to 3 groups of young volunteers, being the major metabolic changes observed in the cold waters (Srámek et al., 2000).

The waters with temperatures between 22 and 33°C are recommended in body care and skin cleansing (Mourão, 1992).

Through clinical trials registered with 10 volunteers performing 30 °C dip baths, evaluated for the first time some neurological effects by physical sensory analyses. The evident changes in steroids begin to explain the benefits somatossensorias related to balneotherapy (Sato et al., 2012).

Analysis of cardiac functions of 10 volunteers subjected to immersion baths (with head) with temperatures of 30°C 34.5 and were differentiated the highest increases blood flow, blood pressure diastolitic and peripheral vasoconstriction (Park et al., 1999).

On comparative study of effectiveness for immersion baths in spring water Leopoldine (Italy) in the treatment of psoriasis in 10 patients, during 4 weeks; It was demonstrated that under the same temperature of 27.2°C the water from this SPA contributes significantly more positive results with that of distilled water tested (Tsoureli-Nikita et al., 2002).

Aquatic therapy or hydrotherapy is therapeutic modality that uses technique of immersion baths with temperatures of 32 to 34°C for differentiated water compositions, including the oceanic. The main indications are: disturbances of articulation (osteoarthritis and rheumatoid arthritis), musculoskeletal, backaches, acute injuries (fractures and sprains), post-surgical conditions, prostheses, neurological disorders (stroke and Parkinson 's) and healing of wounds (Kron, 2007).

6.7. Tepid (warm)

The warm waters related term is found in international rankings and in the bibliography consulted, referring to temperatures above to intervals adopted in this work. Comes from countries with colder climates that the Brazilian and their different habits and thermal sensations of comfort lead to a search for greater warmth for your heating through the waters, for the inhabitants of tropical regions (Estela, 1998; Makaremi et al., 2012).

With water temperatures of 18 to more than 30 °C are cited as fresh. Studies of partial baths and dips quickly (2 minutes) in fresh waters of 22 °C are compared to those performed in cold waters to 8 °C in order to treat muscle injuries after physical exercises of 9 athletes. The results were positive for both temperatures, but with smaller streams in the cooler bigger cutaneous vasoconstriction though powerless to 22 °C (Gregson et al., 2011).

Clinical trials with 175 patients demonstrate that water used in colonoscopies can also have cool temperatures, between 20 to 23 °C (Lee et al., 2012).

As already mentioned, comparative studies demonstrate greater metabolic changes in colder waters baths, i.e. 20 °C (Srámek et al., 2000). Immersion in water with temperatures below 20°C stimulates thermogenic processes and cutaneous vasoconstriction (Franchimont et al., 1983). In this way, the selection of the minimum value of potentially bioactive component warm temperature (Mwarm) if substantiated Australian work, where a temperature of 18.1°C (Stocks et al., 2004).

6.8. Cool (cold)

Baths in cold waters, while short-lived, produce recognized restorative tonic, stimulant reaction, due to increased heart rate and respiration, in addition to the dilation of blood vessels, increase muscle tone and metabolism (Becker, 1994, 2009), in accordance with the descriptions 8 °C (Gregson et al., 2011) and 14 c (Srámek et al., 2000).

Observations of physiological responses induced by prolonged immersion in various parts of the body of 20 volunteers, with water at 5°C, showed that the general and local physiological responses of upper limb differ according to the area immersed, and hand and arm resulted a bradycardy (Sendowski et al., 1997).

Study conducted by partial immersion of 14 individuals in water with 42 and 4 °C did not find differences to environmental hipohidratação (O'Brien and Montain, 2003).

The trial in 10 professional divers under conditions of prolonged immersion at temperatures of 34, 18 and 10 °C confirmed the sharp difference in plasma volume decrease and loss of bodily fluids for the cooling of the aquatic environment (Jimenez et al., 2010).

Compresses of distilled water and saline solution being applied on irritated skin with contact dermatitis reported similar positive results when in cold temperature (18°C), demonstrating relevance of this physical property (Levin and Maibach, 2001).

CHAPTER 7
GASES AND EMANATIONS

The predominant mechanisms of gas migration in fractured and porous rocks may include the continuous directed flow gas-phase dry offset by pressure or saturated water-oriented motion induction by bubbles and micro-bubbles. Its main controls are: lithological types, soil types, billing degree or porosity, water content, intergranular geomorphological systems, quantity of bubbles, the presence of other gases or fumes, environmental and weather conditions such as localized decompressions mirrors of faults or caves (Etiope and Martinelli, 2002).

The terrestrial subterranean gases include highly reactive species (H2O, CO2, H2S, O2, NH3, N2, H2), less reactive (CH4 and heavy hydrocarbons) and inert noble gases (mainly He, 222Rn, air). The phenomenon of emanation occurs if it escapes from the crystal structure of mineral origin (especially a radionuclide) and exhalation when escapes to the atmosphere (Rahaman et al., 2003; Vaupotic and Kávasi, 2010).

Perhaps the best known example of bioactivity of gaseous fumes is the Oracle of Delphi (Greece), where prophecies and trance-like States are common, probably due to the escape by offshore of the gases methane, ethane and ethylene in particular.

Will be shown the potential of gaseous bioactivity not dissolved in waters that usually occur along hydromineral fountains and radioactive properties, being the thoron (220Rn), radon (222Rn) and Hororradioatividade (HORO) when available all these values to be summed and then multiplied the flows of its sources or spurts. The exhibition forms consist of emanatoriun, inhalations, aerosols (Yamaoka, 2006).

The main gases that can be naturally dissolved in water are: CH4, N2, C2H6, Ar, H2, He, Ne, O2, H2S, CO2 and Rn (Dyck and Jonassoy, 1977), however, only the last four are better known as physiological activities sufficient to classify mineral waters. Its specific properties of high power of diffusion, permeation and cutaneous bioavailability, confer them highlighted interest as bioactive components (BAC). Being detailed here 4 ways of these dissolved gases that lie in waters O2, CO2, H2S and 222Rn now dissolved in the water.

7.1. Radon Scattered at Source (^{222}Rn gas)

The radioactivity in hydromineral fountains may occur as: gaseous originated mainly from radio and thorium, emanations dissolved in waters or transferred into the air, waters of radioactive salts dissolved or colloids present in waters and radioactive substances in rocks, soils, incasing mining environments or caves (Ródenas et al., 2008).

The radon at concentrations of 10-100 ppm is considered a trace gas in the crust and surface. However, is the biggest contributor in human exposure to radiation, with 55% of the total. Probably because of its high solubility and gaseous form, is typically the most common and most radionuclide content of waters; being considered of fundamental importance biochemistry. Has 7.6 times the density of air (Vaupotic and Kávasi, 2010).

Its origins can be natural or artificial, through elements usually distinct and, when natural, feature less intensity of radiation and greater spatial dispersion. Some of the natural radionuclides are 228Ra, 226Ra, including 210Pb, 210Po, 230Th, 238U, 40 k. Mostly of groundwater this property is related to the 40 k, and 0.012% of the land is of this type of potassium isotope (Tölgyessy, 1993).

The main exceptions are aquifers near the deposits of uranium and the granite bodies related, where thorium and uranium are more common. As some minerals generators through their hardiness and ability are hokutolita, radiobarita, naegita, zirconite, monazite, columbite, fergusonite and ortita (Michelan, 2000).

Of the many times that are related to recent volcanic and seismic activity, these fumes can sway even in hourly or daily scales (Vogiannis et al., 2004). Ionizing potential holds great influence on the physico-chemical composition of the aquifer around the behavior of atmospheric ions, as well as the total of bioactivity (Sakoda et al., 2007).

3 are known radioactive isotopes of the element Rn, under gas: radon (222Rn), thoron (220Rn) and actinônio (219Rn); from the decay of 226Ra radio, 224Ra and 223Ra; whose half-lives are of 3.8 days, 55.6 seconds and 3.9 seconds, respectively. All can occur in emanations of hydromineral fountains, inducing radioactivity and ionizing power of potential physiological actions long ago searched (Kolar, 1999).

Although actin and thoron possess strong induced radiation similar to that of radio, its fumes are short life and present only while on surgência the spring. Thus, 219Rn wasn't here considered and 220Rn only as emanation of bioactivity in the place of its occurrence.

Classification policy for mineral waters in Brazil, when it related to temperature and radiation, forcing the later use of the term "at the source"; namely, the waters are considered thermal mineral and/or radioactive if they are in their natural deposits (springs or wells). Not being quantified such close proximity in this text, there is the suggestion in 40-metre radius surrounding the Sacred sources set the temple Bakreswar (India) as sampled area for their assessments of bioactivity the visitors (Chaudhuri et al., 2010).

As minimum value in potential bioactivity of radon seeping near the hydromineral fountains in therapeutic applications (M222Rngás) is the suggestion of 52.5 Bq/l 222Rn (Andrade Jr., 1928). Radontherapy techniques via nebulizer inhalation and noted the recommendation of 67.1 Bq/l 222Rn (Mourão, 1992). In crenotherapy environments of emanatórios SPA in Eger (Turkey) minimum levels were analyzed small, with up to 4.2 Bq/m3 of 222Rn (Deák and Nagy, 2013).

The radon is faster absorbed via mucous membranes via inhalation than for baths and when in gaseous form may contain concentrations two to twenty times higher than that in the form dissolved in aqueous solution. Thus, adding to the information that between 70% to 90% of the gas radon dissolved in water to air escapes radioactive of balneotherapy environments (Desideri et al., 2004; Voronov, 2004); every few samples here compiled to the Brazilian database, where at least his presence is established, are classified as potentially biologically active.

A lot of the bibliography consulted expressed the radon seeping in Bq/m3. In waters with 85.9 Bq/l of 222Rn is not dissolved in relief the influence on the increase of its concentration in the ambient air (Deák and Nagy, 2013). However, there are some tips to estimate the contribution in the amount of radon found in the air, especially of Interior environments, due to its release or escape of the solutions present.

For each 1.0 Bq/l in air water is needed with 10000 Bq/l of dissolved 222Rn (Gómez and Martin-Megias, 2010), or a water-containing interior environment with 1000 Bq/l of dissolved 222Rn have their content in the air with a minimum of 100 Bq/m3 and to calculate its estimate of annual effective dose be of 200 Bq/m3 of 222Rn (EC, 2001).

As reference values of 222Rn cite: the estimated concentration in the atmospheric air is 4.0 Bq/l (Besançon, 1990), while his overall average indoors is 27.2 Bq/m3, in Italy 75 Bq/m3 in India 67.1 Bq/m3, in Brazil 14.3 Bq/l and the maximum concentration permitted by the World Health Organization is equivalent to 100 Bq/m3 (Desideri et al., 2004; Marques et al., 2006; Chaudhuri et al., 2010).

The average radon exhalation rate Worldwide is 57.6 Bq/m2/h and one of the largest concentrations are found in the source Bad Gastein Heilstollen (Germany), with 40000 Bq/m3 of 222Rn given to intense therapeutic use. On the linear hypothesis without limits (LNT-linear non-threshold) tested on biopositivos effects of exposures at low radiation of radon, the indications of the minimum necessary therapeutic oscillate between 148 and 500 Bq/m3 of 222Rn (Becker, 2003).

Recent experiments on Guinea Pigs have been made through inhalations during one day, with the following efficacies: improves liver antioxidant function and inhibition of alcohol toxicology in 4000 Bq/m3 222Rn (Toyota et al., 2012), the easing of symptoms of diabetes and potentiation of enzymatic antioxidant activities in 3500 Bq/m3 of 222Rn (Kataoka et al., 2011) or 18000 Bq/m3 in the gaseous environment of 222Rn source of Ikeda-Misasa (Japan) (Kataoka and Yamaoka, 2012), as well as through aerosol produced with its water containing 13000 Bq/l dissolved 222Rn (Yamaoka, 2006).

Similar searches in humans, with lower concentrations, anti-inflammatory and demonstrated capacity for inhibition of swelling through inhalations in environments with 2000 Bq/m3 222Rn (Kataoka et al., 2012). Clinical trials of greater period (28 days), anti-inflammatory and anti-oxidant capacity indicated in patients with asthmatic bronchitis, treated in sections daily 40-minute inalatórias in emanatorium with 2080 Bq/m3 of 222Rn (Mitsunobu et al., 2003).

The physiological effects that can be obtained through the emanations are radioactive: lipid level activities promotes healthy cell growth inhibition of morbid cells simultaneously; produces the diuresis; stimulates the digestive activity and alleviates constipation; increases the excretion of uric acid; decreases blood pressure by dilation of blood vessels and decrease in blood viscosity; increases sexual activity and reproductive capacity and modifies the composition of blood through the reduction of white blood cells and red increase (Kolar, 1999; Yu and Kim, 2004; Giacomino and Demichele, 2012; Deák and Nagy, 2013).

The diseases listed for the emanoterapia are: ankylosing spondylitis, degenerative joint disease, spondyloarthritis, boost myofascial release tissue syndrome, ovarian hypofunction, allergic bronchial asthma, chronic bronchitis, gout, rheumatism, chronic articular rheumatism, rheumatic arthritis gonorreal, neuralgias, high blood pressure, premature aging and gynaecology (Pratzel and Schnizer, 1992; Mourão, 1992; Becker, 2004).

Inhalation of its fumes and aerosols natural gases or dissolved from the fonts have sedative effects, pain relievers, decongestants, anti-inflammatory, desensitizing and restorers neurovegetativos. In this way, are also indicated in diseases of the respiratory system and their ways, such as: nasosinusais diseases, chronic rhinitis, rinofaringites, adenoites, laryngitis, bronchitis, bronchiectasis, laryngeal nerve paralysis, efizema, asthma and other chronic pulmonary diseases (Frangipani et al., 1995).

7.2. Thoron Released at Fountain (^{220}Rn)

The thoron (220Rn) is a gaseous radionuclide from the decay of thorium (232Th) and has a short half-life of 55.6 seconds. The average concentration of thorium in soil is estimated to be 25 Bq/kg. In General, its instances are associated with uranium and rare earths from monazite, torita, thorianite, uranotorita, zirconite, esfeno or allanite, present mainly in granite, syenite, pegmatites, acid and black shale intrusions. The basalts, limestones and sandstones typically have low concentrations of this element (Ramachandran, 2010).

The 220Rn contents are governed by soil fumes, contents of the underlying 232Th, soil types and environmental atmospheric conditions. Their exhalation rate is estimated to average 3 Bq/m2/s. Being of different radioactive series of 222Rn, has also distinguished environmental behavior, although with many similar chemical characteristics (Vaupotic and Kávási, 2010). Your measurements have been used as a tracer of various characteristics of natural environments: contents of other radionuclides, proximity of prospective targets, type and age of springs or mineral deposits (Prasad et al., 2008).

The presence of thoron in soils is very limited to increased inter granular water content and, unlike the 222Rn, its concentration in groundwater is little affected by physical agitation. The relative scarcity in aquifers is related to reduced interstitial spaces and slowness of the water flow before its short half life. Being a typical monazite, thorium source using this mineral under water flow to thoron fumes, especially in hydrotherapeutic uses (Huxol et al., 2012).

Thoron's contribution could reach 10% of the total annual radiation dose received by the population in various countries. Some measures of average concentrations of thoron present in the air of residential environments (Bq/m3 of 220Rn): 19 in Brazil, 40 in Korea, 53 in Ottawa (Canada), 98 in Hungary, 3297 in Yunnan (China) Ko-Chiu, 160 in Serbia, 37 in SPAs and 840 in caves of Slovenia (McLaughlin, 2010).

In Japan, it is common practice to conduct artificial SPA baths with fumes produced by water flow on pads or radioactive minerals where surrounding environments, if there are contents greater than 20000 Bq/m3 of 220Rn and 700 Bq/m3 of airborne 222Rn (Ishikawa et al., 2011).

Few data were found concerning concentrations of 220Rn in hydromineral fountains. The regional Assembly springs in Austria the average is 0.1 to 0.2 Bq/l (Huxol et al., 2009). In a health source in Switzerland the value is 1.4 Bq/l 220 Rn (Huxol et al., 2012). Analyses on bottled mineral waters 13 of France, Italy and Morocco; revealed levels between 0.91 and 3.4 Bq/l of 220Rn and 4.2 to 8.6 Bq/l of 222Rn. In five spas of Morocco the average concentration of thoron in their sources of mineral waters is approximately 15 Bq/l of 220Rn (Misdaq et al., 2012).

The main physiological activities and therapeutic indications are similar to those of radon (222Rn). Before scarce bibliography with this focus, cites the clinical study of 3 weeks of exposure to Japanese hot springs containing thoron, where they found bioactivity about reductions in lipid peroxides, assisting in treatments against hypertension and diabetes mellitus "(Kataoka et al., 2006).

Another random analysis with individuals exposed an hour per day for 2 weeks in emanatorium environment of a thermal centre of Japan containing 4900 Bq/m3 of 220Rn dispersed in indoor air, indicated antioxidant effects and potential therapeutic applications in the treatments of diabetes mellitus, rheumatoid arthritis and other aging-related diseases (Aoyama et al., 2012).

Therefore, even though this gas may soar in the form dissolved in water, its biochemical activities positive or negative, are regarded as in emanation contained air volume and even possessing a brief existence, the vast majority of the research on thoron focus on their exposure risks indoors, quantified in Bq/m3 of air and originated in soilsconstruction materials or pollution. This is also due to the risks arising out of the elements generated by its radioactive decay (McLaughlin, 2010).

In this compilation, the only policy found on the classification of torioativas waters is the Brazilian, although thoron is also remembered by the techniques of Japan onsen balneotherapy (Michelan, 2000). Thus, the minimum value for potential biological activity of thoron (M220Rn), follows national legislation corresponding to 26.92 Bq/l 220Rn (BRAZIL, 1945).

It is worth mentioning that were also few data from hydromineral fountains of Brazil with the thoron levels, with the majority of old publications. Even the Government Laboratory responsible for hidroquímicas analysis and official ratings for decrees of lavras hydromineral fountains, has been conducting such evaluations. In recent work with thoron analyses in some spa towns of São Paulo and Minas Gerais (Salim et al., 2012), significantly lower values are observed in historical assessments to those obtained for the same locations.

Their exhalation rate is estimated to average 3 Bq/m2/s. The presence of thoron in soils is very limited to increased water content Inter granular presence of other gasesDatabase query published as "Clinical Trial, Journal Article and Review", with the words considered key mineral water "" AND "" or "" thoron 220Rn in specialized digital database with 1 http://www.ncbi.nlm.nih.gov/pubmed result.

7.3. Hororadioactivity (HORO)

In a natural spring of water usually accompany this subsurface surgente flow gases dissolved in solution and/or gases directly dispersed in the air, emanated through the exhaust vents of the springs or wells. Among these gases, radioactive radon and thoron, long ago aroused interest of researchers due to increased bioavailability in the vicinity of sources of ionising properties that influence other elements and to increase the electrical conductivity of the air in the environment (Cotar and Harley, 1913).

Thus, the power from a radioactive source municipalities can be calculated through the concentration of radioactive gases dissolved in the water discharge volume added to their streams from on site. At the beginning of 1900, this property was named as Horo-radioactivity and consisted in an attempt to explain the obvious biological activities of waters with reduced concentrations of salts, through exposure to radioactive emissions of natural low dosages under renovation and continuous motion by the body (Piéry and Milhaud, 1924).

Discharges in water sources and gases from can also be leveraged by increasing the influence of radioactivity, temperature and other properties, by absorbing higher amounts of alpha particles by time of exposure, in Hydrotherapies in waters stored (bathtub or pool), is called by hororradioatividade (Bq/m3/h).

Initial studies have shown that in radioactive water baths, the radiation emitted by the alpha particles do not penetrate beyond the outer layer of skin, being beta and gamma emissions responsible for dosage absorbed by the body in this kind of exposure (Yu and Kim, 2004).

Currently, calculations for this kind of exposure (primarily to radon) the epidemiological safety in everyday household and occupational dose baths in ventures with radioactive hydromineral fountains (radon or radium hot springs "), such as hotels, resorts, radioactive mineral water bottlers, etc.

As such studies involve several variables, some estimates tend to consider (Vinson et al., 2008):

.Dissolved radionuclides in bath water, which also are responsible for the inhalation of radon and thoron (emamações and decays);

.Radioactive Gases in motion in the air, in healthy environment, with aerosol (natural climates, waterfalls, mists, evapotranspirações) and

.Heat influence of differentiated way biochemical nature-related activities (ionic reactions).

Principle of spatial balance, where the energy emitted per unit mass of water is equal to the energy absorbed per unit of body mass, being that in water baths, natural flow continuous current allows a significant increase in renewable area of exposure.

Although scarce, even today are work related to this property in Radon SPAs as, for example, on the Greek island of Lesvos (Vogiannis et al., 2004). This type of estimate must be added to dosage calculations for occupational exposure, as has been done in hotels of radon in China (Song et al., 2011).

The assessment of radioactive gases from hydromineral fountains is complex and its analyses show large fluctuations. Can be considered potentially therapeutic according to the quantity available and with levels from 52.5 Bq/l of air (Andrade Jr., 1927).

The index of hororradioatividade emerged in an attempt to better estimate gaseous radioactive phenomena in hydromineral fountains and its effects. It was created in the early decades of the last century, pondering the product of the levels of radiation for the flow of its gas for an hour. Thus, the radioactive power source consists of the municipalities of sum hororradioativa of gases given off spontaneously and with part of these dissolved in tap water. Normally, the coefficient of solubility of gases dissolved in the water, at room temperature and standard balneotherapy conditions, is considered of 0.25 (Andrade Jr., 1928).

In the fountain in Águas de São Pedro Gioconda/SP, with gases given off in 57.1 Bq/l, also estimated the total hororradioatividade 976008 Bq/h, as noted in the table below.

For the Office of Vine/BA, where the flow is 32220 l/h, the concentration of radon dissolved in 187.9 Bq/l, the gas flow is 2215 l/h and the concentration of radon seeping is 57 Bg/l, a 20-minute bath was estimated at 1331208.8 Bq/h of hororradioatividade (Lobo, 1961).

HORORADIOACTIVITY – AGUAS DE SÃO PEDRO/SP

	Vazão		**Radon**		**Hororadioactivity**		
	liter/h		**Bq/l**		**Bq/h**		
Fountain	água	gás	água	gás	água	gás	total
Juventude	12.500	430	2,59	14,79	32348,5	6284,9	38633,3
Gioconda	14.500	60	66,55	184,90	**964909,1**	11090,9	976000
Almeida Sales	2.500	200	14,79	14,79	36969,7	3696,9	40666,7

Source: Pupo (1940)

In the same way as the above work, the selection of the BAC hororradioatividade (HORO) has as its criteria: only sources of spontaneous flow and presence of thoron and/or radon seeping in. So will be added: the product of the flow of water with the dissolved radon, plus the products of the levels emandos with gaseous flow. There is no gas flow data, this will be considered in 1/10 of the water flow. The values obtained so divided by 3600 (seconds in an hour) and how to choose random minimum at 50 Bq/sec.

7.4. Radon Water Dissolved (^{222}Rn)

Several radioactive elements can be present in water, such as uranium, radium and thorium. The average concentration of uranium in basalts is 0.87 ppm and in Granites 3 ppm, the thorium in basalts is 2.93 ppm and in Granites 13 ppm. Radioactive waters are usually denominated in function of its contents of dissolved radon gas (222Rn), and atmospheric waters, the cosmic radiation is also an important generating source (Tölgyessy, 1993).

The radon comes from alkaline metal decay Radium (226Ra), present in minerals typically easy leaching. The average content of Radium in the Earth's crust is of 40 Bq/kg and under normal conditions of soil saturated with porosity of 20%, usually lead to balanced concentrations of radon in groundwater in the order of 50 Bq/l. Its average concentration in inland waters is of 0.0000001 mg/l and the radon is 0.000000000001 mg/l (Tölgyessy, 1993; EC, 2001).

Being an unstable gas and soluble, is the predominant radionuclide and common in almost all occurrences of ground waters. Its concentration depends not only on the quantity of the parent 226Ra, but also the efficiency of emanation of substrate as is (Brezonik and Arnold, 2011). The turbulence and physical impacts facilitate the escape of this gas to its dissolution, not recommended capturing by pumping or abrupt breaks in your flow in cases of radioactive sources approved health for therapeutic applications (Mourão, 1992).

The contents of radon found in samples of Brazilian waters is 0.95 to 36 Bq/l in groundwater, the Bq/l 2.4 0.43 in rivers, the Bq/l 0.3 0.54 at sea and 0.39 to 0.47 Bq/l 222Rn in public distribution (Marques et al., 2004). The average calculated on sampling of drinking water United States ' public is among the 37 7.4 Bq/l of 222Rn (Becker, 2003). In hydromineral fountains assessment of Brazil is estimated an average of 57.7 Bq/l of 222Rn, being greater in the South and Southeast with about 144.3 Bq/l of 222Rn (Godoy and Godoy, 2006).

In aquifers of granitic rocks are their greatest average levels (300 to 2300 Bq/l), especially in pegmatites. In sedimentary rocks between 3 and 40 Bq/l, and may increase in the presence of peat and enriched radioactive mineral carbonates (Banks et al., 1998). Its solubility decreases with increasing pH and total dissolved salts

(STD), but mainly as a function of temperature can reduce by up to 4.5 times the heating of 0°C to 75°C. (Soto et al., 1995).

The following conversion factors are used to express the radioactivity due to radon: 1.0 Bq/l = 0.075 Mache Unit = 0.027 nCi/l = 27.02 pCi/l.

Ratings for radioactive waters have minimum levels quite differentiated, according to the laws of each country, being (222Rn in Bq/l): Italy-48, Cuba-67.3, Poland-74, Japan-110.7, Brazil-134.2, Russia-185, France-370, Czech Republic-1192 and Germany-6885 (Fagundo et al., 2001; Voronov, 2004).

For their bioactivity through the daily consumption of drinking water (D222Rn) the maximum value follows the recommendation of the European Commission (EURATOM) in 1000 Bq/l of 222Rn (EC, 2001), when the effective dose absorbed per adult is estimated to be between 0.2 to 1.8 mSv/year and so not exceeding half the total contribution considered safe. To its minimum value, despite the same policy recommend 100 Bq/l of 222Rn, the selected option rests on the argument suggested in children's diet equivalent to drinking water with 32 Bq/l of 222Rn (Nuccetelli et al., 2002).

Your crenotherapy through ingestion is recommended in gastrointestinal pathologies due to effects: sedative of peristalsis and motility, regulator of the neuroentéricos Plexus, stimulant of enzyme activity and gastric juices digestive power and pancreatic (Albertini et al., 2007).

The hidropinia associated with the baths has recognized application, called for "diuresis cure" in renal and urinary tract diseases (lupus nephritis, nephrosis, calculose or lithiasis, cystitis, urethritis, prostatitis and other Chronicles); because the rainfall oxálica, increase the dilution and alkalinization of urine, the Elimination of the phosphoric acid promotes organic oxidation and facilitates the drag calculations by increasing the flow of fluids (Frangipani et al., 1995). More vide uses recommendations (ANNEX TABLE CRENOTHERAPY INDICATIONS).

7.4.1. Dissolved Radon at Bath (^{222}Rn)

Several countries also provides information about radioactive hydromineral sources with healing properties observed in their SPA, Spa, health resorts, spas or sanatoriums. Such knowledge is diffused since ancient times, long before the currently predominant attention concerning risks to your exposure. Mainly through the immersion baths, if attribute potential physiological effects and typical benefits in large numbers of publications (Gómez and Martín-Megías, 2010).

However, almost all the clinical trials and controlled medical assessments occur in locations with high water content of radon dissolved, usually above 1000 Bq/l 222Rn. as an example, the finding of cutaneous permeation after 10 daily balneotherapy sections in water source thermal Bad Gastein (Austria) containing 982 Bq/l of 222Rn (Tempfer et al., 2010). Or clinical trial in rheumatoid arthritis patients, 60 through rehabilitation program, where a series of 15 spring water baths in Bad Brambach/DEU, containing 1300 Bq/l of 222Rn and 1600 mg/l of CO2, demonstrates induction of long-term beneficial effects (Franke et al., 2000).

Controlled clinical studies on 42 individuals through isotermais baths in Jáchymov SPA supply water (Czech Republic) containing 3500 Bq/l of 222Rn, shows that efficacy was observed in a clinical improvement of rheumatoid arthritis (Zolzer et al., 2012). The evaluation of 186 patients with heart disease indicated that balneotherapy favored positive results in more than 90% of cases, where radioactive waters were used 2 spas Russians containing 1478.9 Bq/l and 4436.4 Bq/l of 222Rn (Klemenkov et al., 1999). Research on 141 patients with seronegative spondylarthritis and Spondylitis demonstrated effective anti-inflammatory and analgesic activity similar to 3 immersion baths water from Russian sources, with different concentrations of radon, i.e., 1500, 3000 and 4500 Bq/l of 222Rn (Barnatskiĭ et al., 2005).

For low levels of 222Rn influences were not found on the urinary excretion through therapeutic water baths with 72.4 Bq/l of 222Rn (Kavasi et al.., 2011). A study of pilot balneoterápico 15 days using radioactive waters of the fountain in 27 patients with degenerative disorders musculoskeletal conditions not evidenced efficacy or activity on the endocrine system in Eger (Turkey) with 80 Bq/l of 222Rn (Nagy et al., 2009). As positive exception, found higher antibacterial activity to comparative radioactive medicinal waters of Poland with 74 Bq/l of 222Rn (Serrano et al., 2012), and for this reason the legislation of this country here selected for the minimum value among the international policies.

The less radon content evaluated clinically as respiratory control and positive skin changes, was observed in patients with ankylosing aquilosante, after 3 weeks applying daily immersion baths in radioactive water with 415 Bq/l of 222Rn

(Falkenbach et al., 2005). In this way, this is also considered here as a lower bound for bioactivity of radon therapy potentially dissolved in water (222RnM).

With similar value, 500 Bq/l of 222Rn, positive results were obtained in 40% of 148 patients evaluated for balneoterápico treatment for cervical rheumatic disease, and in the same study, radioactive water to 5000 Bq/l of 222Rn effectiveness was little higher than in 55% of cases (Becker, 2004). This ratio also recommended as activity in balneotherapy for water used in the SPA of Italy (Nuccetelli et al., 2002). Due to effective dose total for exposure of workers of SPA in Greece be limited legally to 3.0 mSv/year, it is considered healthy waters with up to 300 Bq/l of 222Rn (Vogiannis et al., 2004).

Radioactive medicinal waters are widely used for the treatment and pain relief for degenerative articular diseases and espondilartroses, through the balneotherapy in thermal centres of traditional Poland, and cite the sources: Heisig (800 Bq/l 222Rn), Skorepa (400 Bq/l 222Rn) and Swieradow (707 Bq/l 222Rn) (Kozlowska et al., 2001; Zdrojewicz and Strzelczyk, 2006).

The minimum value adopted as bioactive in baths (222RnB) takes as a benchmark the quality criterion proposed by European SPAs Association in 666 Bq/l of 222Rn (ESPA, 2006), founded by several researchers in the sector of hydrotherapy and also relating to European Association Radon Spas (http://www.euradon.de).

Isotermais baths (36 to 38°C) for 10 to 20 minutes in radioactive water oligominerais are indicated in cardiovascular pathologies due to increased diuresis and the generalized vasodilation, decreased blood pressure and oxygen consumption or bradicardizantes (Frangipani et al., 1995).

The reactions, accumulations and adaptations to the radionuclides are quite differentiated between living organisms (Besançon, 1990). The main biochemical characteristics of Alpha radiation from radon due its ease of absorption through the skin or mucous membrane and good capability of ionization or excitation biochemistry.

However, this energy emitted of 5.49 MeV has penetration capacity of only 41.1 µm in water and 20 µm in human tissue, also their residence time in the body is short, it is estimated that about 59% of the total absorbed is eliminated between 15-30 minutes. Its final decay is no longer detectable by analytical methods after 3:0 the physiological uptake (Zdrojewicz and Strzelczyk, 2006).

Despite the ancient and intense use of radônioterapia, their mechanisms of action are not completely known, being the theory of hormesis occurs found their best explanations relating the ionizing radiation in low doses and sporadic exhibitions (Thong and Maibach, 2008; Giacomino and Demichele, 2012).

The main therapeutic indications are: musculoskeletal diseases, rheumatic and sequelae of trauma, with analgesic and antispasmodic action; Gotha, central nervous system, immune system, reproductive system, Gynecology, Dermatology and anti-aging functions.

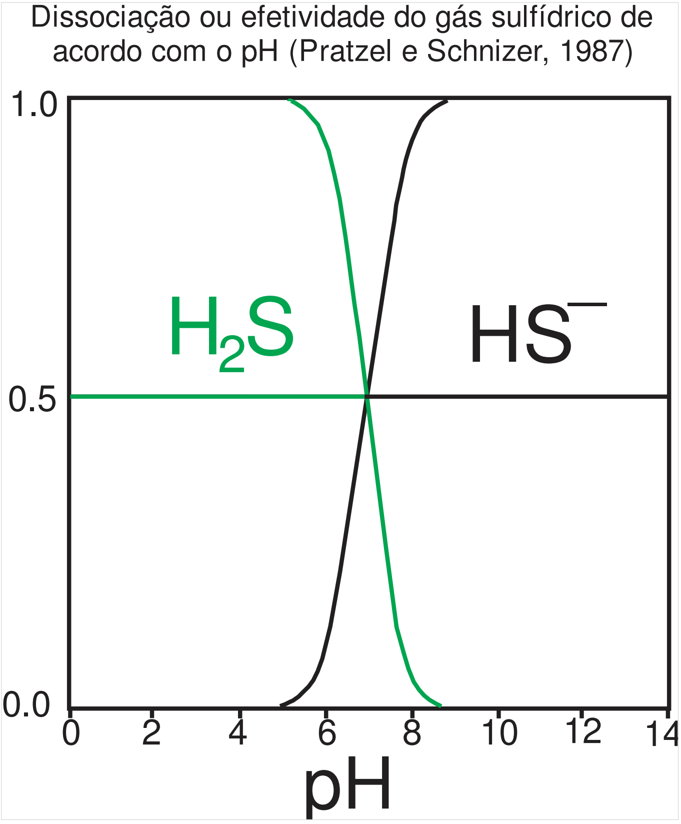
The physiological absorption coefficient of radiations is greatest when at low temperatures and in dilute solutions and may potentiate bioactivity of trace elements present. Being recommend the consumption of these waters as soon as possible, due to the short half-life of their bioactive gases and their yielding decays lead, although with very small concentrations (Yu and Kim, 2004).

Database query published as "Clinical Trial, Journal Article and Review", with the words considered mineral water "AND" key "radon" or "222Rn" specialized database with 20 http://www.ncbi.nlm.nih.gov/pubmed digital results.

7.5. Hydrogen Sulfide Water Dissolved (H_2S)

The hydrogen sulfide is formed when soluble sulphides are hydrolyzed in water, which causes dissociation sulfide ions (S-2) and HS-monohidrogênio sulfide. At pH 6 predominant shape < hydrogen sulfide (H2S) and coupled between pH 7.5 and 12 predominant ionic form HS-(SULFUR DISSociATION FIGURE below). In waters with high aeration, the sulfide is quickly oxidized in sulfates and biologically oxidized to elemental sulfur, being common in anaerobic environment occurs in the reverse reaction by microbial reduction or catalyzed by the presence of some metals, such as Mn2 +, Ni2 + and Co2 + (Tölgyessy, 1993).

Currently there is a growing increase in utilization and biochemical research, medicinal, pharmacological and gas-related sulphide and sulphurous waters. Due to the wide variety of its components, complexity of physico-chemical behavior and dynamics of its redox potential; many of its features and potential effects are still unknown.



In laboratory experiments (Ciocan and Vîlcu, 2004), it can be observed that the temporal behavior of the sulphurous waters depends on factors such as temperature on emergence of springs and their variation in time, chemical composition and respective ionic strength of the solution, concentrations of H2S and HS-and less of the other sulphur compounds, oxygen partial pressure and pH of the solution.

It is quite obvious the intensification of the phenomenon of oxidation, the more alkaline pH. The waters with a high content of H2S and pH on source between 7.4 to 7.6 has a higher percentage of extractable colloidal sulphur, than that corresponding to the H2S and HS-or even S2O3 indicating the presence of some anions rich in sulfur, such as polysulphides.

The redox phenomena can be determined by the oscillations of the anions S2O3, increased concentration of SO4 and colloidal sulphur deposits. In case of absence of polysulphides, they may be estimated through calculations and depending on temperature and pH of the reaction between H2S and HS-. The tendency for oxidation of sulfur compounds from the oxidation state (H2S, HS-, polysulphide) is closely correlated with their concentration and partial pressure of oxygen.

Due to high chemical stability of sulphates and low of sulfides, these are less common and smaller concentrations in natural waters, an average of 1 mg/l and in rare cases with 500 mg/l of H2S, as observed in surface water sample in the United States. In groundwater, their average levels tend to be higher, especially in volcanic environments and sedimentary deposits, when associated to hydrocarbons, they contain over 1000 mg/l dissolved H2S in fluids.

Increasingly common noted its origin related to the various human activities. Among all the elements found in the work of the World Health Organization, this was the only cited as typology of water (sulphurous water) with therapeutic properties (WHO, 2003).

The sulphurous waters must contain at least 1 mg/l of sulphur, in various forms, such as H2S, HS-, S-, sulphide Group 2 (alkaline, carbonated, soda or mixed cloretados), complex colloidal sulphur or polysulphides tiossulfatos acids. Sulphites and tiossulfatos are quite rare and usually originate due to pollution. Measurements in degrees of sulphur hidrométrico can be converted to mg/l, multiplying the result by 7.93 (Gallino et al., 2008).

Although most international policies, included Brazil, consider as sulphurous waters those with levels above 1 mg/l of reduced sulphur compounds, not met scientific articles with therapeutic or pharmacological evaluations in water sources with this content. It is also believed that some of the sources compiled in this Brazilian hydro reported this exact concentration, with empirical basis of their odors.

The lowest value found with clinical trial demonstrating positive treatment bioactivity of two weeks was the Terma SPA Stabia in Castellammare (Italy), where used water from two sources (Stabia and Sulfurea), containing 2.4 and 2.7 mg/l of H2S, respectively. Employed three groups of ten Guinea Pigs each, ingesting daily these two sulphurous mineral water, chloride and bicarbonate, being a placebo group. Through the blood of all individuals, whether noticed evidence of antioxidant effects, potentially curative and preventive for diverse pathologies (Constantine et al., 2009). Thus, the value of 2.4 mg/l of H2S is adopted as minimum for potential medicinal bioactive sulfide gas (MH2S).

Similar values are observed in traditional SPAs, indicated for treatment of dermatitis, rheumatism and problems of otorhinolaryngology, the sulphurous waters of Guitera, Bareges and Caldanelia in Corsica (France), with 2.6, 3.9 and 4.9 mg/l of H2S, respectively (Michard and Roekens, 1983; Michard, 1990). In in vitro experiments were also observed metabolic benefits about the activities of erythrocytes, through the short-term intake of sulphurous water thermal centre Macerata Feltria in Pesaro-Urbino (Italy), with 3.84 mg/l of H2S (Albertini et al., 2008).

Many studies found on sulphurous waters of higher levels and for various health benefits (ANNEX TABLE of INDICATIONS CRENOTHERAPY), stand out only two studies, represent the growing interest of balneology therapy integration to the problems of chronic diseases (Olson, 2013).

For example, in directions in combating bad cholesterol, circulatory problems and chronic heart, as is the case studied in sulphurous water, sulfated and cyanamide-magnesian of Fonte San Giovanni SPA in Rapolano (Italy), with 6.1 mg/l of H2S (Nasuti et al., 2005). Or still in evidence in the improvement of the quality of life and reduction of side effects related to diabetics, in pharmacological study through the water of sulphurous hidromineral Source in Helwan Kabritage in Cairo (Egypt) with 8.4 mg/l of H2S (Sadik et al., 2011).

Due to the excellent skin permeation of gas power in sulfurous bath and the large amount of dermatological indications, the minimum content for their potential biological activity on external display (BH2S) is less than the adopted for therapies. And its value is based on the extensive knowledge acquired in dermatological indications of Sulphurous French Resorts: Thermes d ' Amélie-les-Bains, Beauté, Cauterets, Eaux-Chaudes, with 1.37 mg/l, 1.88 mg/l 1.7 mg/l and 1.44 mg/l of H2S; respectively (Alaux-Negrel et al., 1993; Popoff, 2010).

This minimum value is also similar to that of 1.9 mg/l the SPA water Ipati (Greece), which has recommendations for skin care (Katsambas and Antoniou, 1996; Matz et al., 2003), as well as the famous sulphurous water (2.3 mg/l of H2S) curative of Harghita Bai Village (Romania) (Alexandru, 2011).

Are considered exciting desensitizers and dilatadoras capillaries. In respiratory pathologies have plastic functions due to sulfur integrate the structures and tracheal, bronchial, rinofaríngeas of dynamic/energetic through the mechanism of oxidation-reduction, transmethylation, and trans-besides sulphuring antiseptic and restorer of the epithelium. Also stimulate catarrhal secretion elimination, regulate the vegetative tonus, bronco dilatadoras, antiallergic, antitóxicas, vasodilator and catalytic (Frangipani et al., 1995).

The same application forms are the most commonly used in dermatological pathologies treatments due to antiseptic properties, desensitizers, ceratolíticas, antisseborréicas, antiseptic and anti-parasitic. The hydrogen sulfide gas, which is absorbed in baths or topical applications (external), AIDS the synthesis of amino acids, especially in containing sulphur (cystine and methionine), facilitating the regeneration of skin keratin. The skin is also furthered through their intake by increasing bile secretion and intestinal peristalsis, encouraging nutritional processes, favoring the desensitization and organic detoxification (Laguarda, 2002; Nunes and Tamura, 2012).

The dissolved content of hydrogen sulphide gas water recommended for everyday drinking as potentially bioactive in nutrition (DH2S), takes as parameter maximum concentration where begins the human sensitivity to its unpleasant odor, estimated at 0.8 mg/l of H2S (WHO, 1993) and the minimum parameter to provide at least similar to the contribution of other electrolytes in total daily typical nutritional recommendation, i.e. approximately 20% of the content of 1 mg per litre of a water classified as sulphurous (Tubek, 2006).

Database query published as "Clinical Trial, Journal Article and Review", with the words considered mineral water "AND" key "hydrogen sulfide" or "sulphur", or "H2S" on a specialized digital database http://www.ncbi.nlm.nih.gov/pubmed provided 15 results.

7.6. Carbon Dioxide Water Dissolved (CO_2)

Carbon dioxide is a gas relatively soluble that hydrolyze, produces carbonic acid partially dissociated. Their average oceanic waters features concentrations fluctuate between 34 and 56 mg/l of CO2, at 0.36 mg/l rain and surface fresh waters between 1 and 30 mg/l, presenting lower values when in contact with the atmosphere. In aquifers, reached 26.6 mg/l of CO2 but at acidic pH and other conditions can exceed 1000 mg/l of CO2 (Shvartserv, 2008).

All water contains some amount of carbon in solution and the total dissolved inorganic called DIC, composed of different concentrations of three major chemical forms (HCO3-, CO32-and CO2) being the first broad field in surface water and the highest CO_2 dynamics and variability. Are controlled mainly by the pH, being: at pH < 4.5 there is absolute predominance of CO_2 in pH of 8.3 to the $HCO_3^-$and at pH > 10.5 of the CO_3^{2-}(Brezonik and Arnold, 2011).

Typically occurs as dissolved molecule and freely hydrated and less than 1% of its volume reacts with water to form molecules coupled of H_2CO_3. Due to its high solubility in water and very low hydration degree, is expelled from this solution before processing or minimum aeration and, therefore, its contents do not have toilet significance as oxygen (Tölgyessy, 1993).

In unpolluted air, the CO_2 volume corresponds to 0.03% of the total and in these conditions only 0.7 mg/l is dissolved in distilled water, and this higher proportion in the regions of contact with the surface than other parts of the atmosphere. Their presence in water rock interface is closely related to temperature, being estimated in the reservoirs of origin between 100 and 180 °C (White, 2013).

Some explain the occurrence of CO_2 under the freeform soda dissolved in solution due to deep pressure relief in tectonic zones or deep offshore, with sudden change factors such as pressure and temperature. In tectonic regions springs or recent Volcanism is common their emanation, which has been used in the prediction of such activities (Hem, 1989).

Its origin can be organic, through respiration of plants or microbes, oxidation of organic matter or human activities (pollution) and inorganic for dissolution of carbonate rocks or desvolatilizações termometamórficas, dolomitic, mantélicas or magmatic desgaseificações reactions. Some authors also explain its presence in groundwater through the dissolution of evaporites and complex reactions with basaltic rocks (Flaathen et al., 2009).

Most groundwater rich in CO_2 throughout the world are near granite and volcanic areas, and are characterized by relatively low pH and elevated total mineralization (STD). When deeper carbogasosas waters are mixed to dilute more shallow aquifers it is common to observe the enrichment in some compounds of iron and manganese (Choia et al., 2005).

Some cases studied and (his genetic relationship): Cezallier (France) (volcanic, granite), Vichy-Saint Yorre (France) (granite), Mont-Dore (France) (volcanic), valleys-les-Bains (France) (volcanic, granite), Anatolia (Turkey) (volcanic, granite), Volcano Etna (Italy) (volcanic) Island of Pantelleria (Italy) (volcanic), Chivas (Portugal) (granite), Kos Island (Greece) (volcanic), high Guadaletin (Spain) (sediment).Black Forest (Germany) (granite), Daylesford (Australia) (volcanic), Gangwon (South Korea) (granite), Volcano Mount Idhu (Iceland) (basalt), Vrnjacka Banja (Serbia) (gabbro).

The main international policies are classified as those with carbogasosas water levels above 500 mg/l of CO2 (Ivanov and Nevraev, 1964) or even greater than 250 mg/l of CO2 as the European (Popoff, 2010) and 200 mg/l CO2 in Brazil (BRAZIL, 1945). It is the oldest drink in the United States Pharmacopoeia quoted (since 1830), due his stomach benefits (Burney Yeo, 1890).

The work met with scientific evidence of therapeutic treatment through of water carbogasosa containing the lowest CO2 content refers to the source of Chinciano (Italy), with 537 mg/l of CO2. Through the daily intake, for 12 days, was observed improvement in physiological framework of 29 patients with stomach problems of functional dyspepsia (Rocca et al., 2007). So, this will be here established as minimum value for bioactivity of medicinal potential for carbon dioxide (MCO2).

This value is concordant with the minimum of 500 mg/l dissolved CO2 in water used for bathing, when it can be observed the phenomenon of erythema on the skin and therefore with possibility of clinical efficacy through immersion baths (Resch and Just, 1994). Other authors describe even smaller levels of dissolved CO2 in water, sufficient to result physiologic notables such as: thermal equilibrium, sweating, vasodilation, blood pressure and skin sensitivity. For example, to Pagourelias et al. (2011), from 400 mg/l, with 300 mg/l of CO2, according to Schmidt (1999) and for topical applications, in 366 mg/l (Ito et al., 1989).

But as parameter for selection of potential biological activity in baths (BCO2), an even lower content of this gas is described as capable of the same effects, through the hipertermal immersion with waters containing 60 mg/l of CO2 (Sato et al., 2004). The decision about a little content to this bioactivity is also substantiated by the power of cutaneous permeation of this component which is the highest among the gases, 500 times higher than that of water and 5000 times more powerful ion dermal penetration, sodium (Hubner et al., 1982; Pratzel and Schnizer, 1987).

Among the large number of publications compiled, as the source of Nauheim (Germany) (Bauhinus, 1598), some are described below. In the traditional Serbian SPA of Sneznik in Vrnjacka Banja, the water from its source displays 700 mg/l of CO2 and has been used for decades, being the target of numerous published works relating to his effectiveness on treatments for diabetes mellitus and duodenal ulcer (Godic and Radic, 1956). With 820 content mg/l of CO_2, water of Uliveto (Italy), has a lot of evidence about its use in hidropínico researched treatments of dyspepsias (Cuomo et al., 2002; Bertoni et al., 2002; Michou et al., 2012).

The research of greater scope, parameterized clinical trials ("clinical trials") with therapeutic efficacy results, use the balneotherapy carbogasosa with waters containing over 1000 mg/l of CO_2, which is the parameter adopted as basic criteria by the European SPA Association (ESPA, 2006). Antoniuk cited et al. (1996), Hartmann et al. (1997), Nishimura et al. (2002), Persiianova-Dubrova et al. (2002), Bender et al. (2007), Yamamoto and Hashimoto (2007), Sahoo et al. (2010), Vaquero (2010), Poenaru et al. (2012), Hashimoto et al. (2012); they come from various countries and mostly address cardiovascular and Dermatologic problems.

The most comprehensive review found on the topic using MEDLINE Database, EMBASE, ISI WEB of Knowledge, CochRANE database and the main European balneotherapy centres are in Pagourelias et al. (2011) (ANNEX TABLE CRENOTHERAPY INDICATIONS).

Normally in people older than 50 years, the CO_2 levels in the blood are between 30 and 50% below normal, and cause various health problems as constriction of blood vessels, tissues and bronchioles (Vasiljeva and Nias, 2003).

In this way, from a nutritional standpoint, any content of CO_2 can be welcome to potable water. The minimum value of bioactivity dietetics (DCO_2) noted in the statement to the palate of the lightweight type classified by the specialized site www.finewaters.com, because it has good texture and without much saturation of bubbles, which are of intermediate size and quantity, between the effervescent and classical, and may appeal to those who don't like sparkling waters. His example comes from the Source of Loreto (Italy) with 117 mg/l of CO_2.

The average found in bottled water samples 536 of Europe is 391 mg/l of CO_2 (Gros, 2003).

Database query published as "Clinical Trial, Journal Article and Review" with the words "mineral water" considered AND "carbon dioxide" or "CO2" in the specialized digital database, provided 29 http://www.ncbi.nlm.nih.gov/pubmed results.

7.7. Oxygen Water Dissolved (O_2)

Like most abundant element in the Earth's crust, oxygen gas constitutes 21% of volume of atmospheric air and 35% of air dissolved in natural waters, being this increase due to its higher solubility than nitrogen (78%). The main sources of oxygen to water are the atmosphere and photosynthesis. On the other hand, the losses are caused by the oxygen consumption by the decomposition of organic matter (rust), for losses to the atmosphere, respiration of aquatic organisms, nitrification and oxidation abiotic chemical substances such as metal ions, Fe 2 + and Mn + 2 (Tölgyessy, 1993).

The level of its saturation in surface waters is between 10 and 15 candy mg/l of O2, being 20% lower than in the present 8.5 average oceanic mg/l of O2. You can't artificially dissolve up to 100 mg/l of O2 in water (Brezonik and Arnold, 2011). The dissolution of O2 in water depends on its availability in the Middle, larger surface area and contact pressure with the air, lower salinity and water temperature. The 25°C and at sea level, the estimated saturation is 8.11 mg/l (Carpenter, 1965; Connell, 1997).

Contents dissolved in waters of rivers can reach maximum brightness function and shaking of the Rapids, these factors that inversely will reduce its concentration in deeper waters of lakes and underground aquifers. In springs, the oxygen present is usually greater than in the lakes, due its jorrantes streams and rapid change to the outside environment, which facilitates its assimilation. Rain waters, the average is 6.36 mg/l of O2 (Dyck and Jonassoy, 1997).

Among the gases given off naturally in springs or wells, oxygen rarely make up most of the volume deprendido in explotation and when dissolved in water, its maximum concentration is also relatively lower. This might explain the scarce scientific literature found relating their occurrence in hydromineral fountains with applications in health, despite constituting 65% of the human body, their fundamental importance highlighted potential bioavailability and physiological cutaneous permeation (Prabhakar and Semenza, 2012).

As its minimum value for potential bioactivity therapy (MO2), noted positive results in significant reduction of symptoms of dyspepsia in 20 patients treated by ingestion during 10 days of water from the fountain Sponga in Santa Croce (Italy), where its content of 7 mg/l of O2 is also revealed as explanation (Fabiani and Onori, 1997).

Water sources considered oxigenogasosas are cited as differentiated levels of dissolved (above your limit of saturation), where also occur free gaseous, through cracks or fractures, local discharge areas hydrogeological characteristics, rapid movement and aquifers incasing sedimentary not rocks. These waters usually have low mineralization and associated radioactive elements, for example in Brazil, Águas de Lindóia/SP and Termas da Guarda in Tubarão-SC (Mourão, 1992).

These types of occurrence increases greatly the transport and dispersion of radioactive gases associated with, which are heavier, and enhance the physiological effects of their emissions through oxygenation reactions, modification of interfacial coalescence, superficial charges and ionic interactions (Zieminski and Whittemore, 1971). Added the biological activities of oxygen itself, through exhibitions, are expected as the metabolic stimulus effects, cell excitation, the increased blood circulation and diuresis, and may be quite favorable for the treatment of kidney and nervous system problems (Bergel and Williams, 1998; Nielsen, 2000).

As a minimum content for bioactivity balneoterápica (BO2) will be considered the estimated value of saturation in natural waters of 8.11 mg/l of O2 (Carpenter, 1965; Connell, 1997), once in immersion baths in thermal and mineral waters, such value is above this limit and some cutaneous level effects may be noticed, as sedative, protection, action: repair or healing (citofilaxia, citogenia) of chronic dermatitis, acnematosas or eczematizadas, stasis eczema, tórpidas ulcers, allergic skin manifestations, medicinal toxidermias, Dyshidrosis Polychondritis and injuries with hard to heal tissue laceration (Mourão, 1992; Butorina et al., 2009).

Despite the minimum deemed necessary to maintain aerobic conditions (criterion of oxygen demand in water quality) without causing adverse effects to organisms be stipulated at 5 mg/l of O2 (preferably of abiotic origin), the minimum threshold for your potential bioactivity in food (DO2) is adopted on the basis of taste qualities observed in drinking water evaluated by Japanese guests research participants where the smallest content is of 7.6 mg/l of O2 (Koseki et al., 2005). This value is also considered compatible health-friendly by international institutions (WHO, 1993).

The dissolved oxygen in the blood is around 4 mg/l and in plasma water around 3 mg/l of O2. New applications of this gas are being researched in strengthening the immune system, mood induction, combating obesity and cancer (Mathis, 2007).

Database query published as "Clinical Trial, Journal Article and Review" with the key words "mineral water" AND "oxygen" in the specialized database http://www.ncbi.nlm.nih.gov/pubmed 37 provided digital results.

CHAPTER 8
BASIC WATER CHEMISTRY

8.1. Potential Hydrogen (pH)

The pH of the water is a measure, in the ion activity cologarithm hydrogen in solution, resulting initially from the dissociation of water molecule itself, as almost always occurs. In dilute solutions, this activity is approximately equal to its concentration, and total activity of water considered constant. In aqueous solutions, its value corresponds to the point of acid-base balance achieved between the various dissolved components; being in most natural waters controlled by carbon dioxide system-carbonate-bicarbonate. In pure water, the heating to 25 °C represents a decrease of 0.45 in pH (WHO, 1993).

It is considered that the distilled water, in an environment of clean air, temperature of 20 °C and in equilibrium with 0.55 mg/l of CO_2, results in a pH calculated to 5.65. But, in a chemically pure water, ideal equilibrium establishes itself in the balance between hydrogen ions (H+) and hydroxide (OH-), thus representing a neutral pH value of 7 (Tölgyessy, 1993).

In natural waters clean, pH can oscillate between 4.5 and 8.3. Some are average values: in the waters of oceans surface fresh waters 8.2 between 6.5 to 8.5, in shallow groundwater in deep groundwater 6.9 > 7.5 and atmospheric waters with 5.7. In General, surface waters, the low pH is due to the presence of humic substances (peat) and the high pH is related to intensive assimilation of photosynthetic organisms present (Shvartserv, 2008).

The generation of salts and the presence of free carbon dioxide promotes the demotion of pH, while solutions containing carbonates, bicarbonates, hydroxides, phosphates or borates, silicates dissolved usually possess more basic pH. Typically, high waters mineralization (STD), have higher pH. A water system where the carbonate concentration is higher than the bicarbonate, your pH will be around 10 (Brezonik and Arnold, 2011).

Groundwater with the lowest pH are characteristics of aquifers near sulphide ore deposits, evaporite formations or the dry pickles hot springs of active volcanism. The largest pH waters are related to oilfields, sulphated occurrences fossils and nitratadas hot springs. Sedimentary aquifers have pH higher than the crystalline; with the exception of sandstones, mudslides and the karst which are slightly acidic reaction environments (Komatina, 2004).

A compound of hydrogen can generate a hydrogen ion only if their components are dissolved in a medium capable of protons solvation; the energy required to break the links is called solvation. Alkalinity is the ability of neutralization of acids, not necessarily through pH greater than 7 is acidic pH waters may contain salts with such property, especially carbonates and bicarbonates (Sziksay, 1993).

Through survey in the public drinking water supply in the 100 largest cities in the United States, noted that only 17 consume waters with pH above 9 (average 7.5), where the values fluctuated between pH 5 and 10.5. It has not been possible, in this work, evaluate direct epidemiological indications due to presence of other physical and chemical parameters that have relationship with the pH; only bactericidal action (antiviral) can be indirectly associated with high pH (WHO, 1993).

The pH influence considerably the natural phenomena. Waters direct chemical and biochemical processes, being responsible for differentiation of specific shapes like occour several elements, ionic balance, taste and the therapeutic indications, as will be seen. The range of values considered as great and acceptable to the palate for the drinking water is between pH 6.5 and 9.5 (WHO, 2008).

In the region of Xingxi (China) with high incidence of nasopharingitic carcinoma were collected 75 water samples from wells that supply the population for public drinking, being analyzed trace elements and pH 7. Searching for correlations between these variables and the mortality rates due to illness in question, was statistically clear the influence of pH (between 6.5 and 7.3) in levels of other elements and their possible epidemiological correlations.

Characteristics of trace elements such as Valencia, affinity, combination, dissociation, configuration and ionization energy are dependent on environmental factors such as temperature, pH and ions. And to understand its bioactivity it is necessary to evaluate jointly the pH, because its power to enhance the degree of absorption, bioavailability and physiological function (Ling-Wei et al., 1988).

The survey of the quality of drinking water from public wells in Southeast Sweden evaluated the hydrochemistry to 30 elements in 46 towns of a region considered acidic (pH 6 medium) and 43 points in a region alkaline (pH 7.6 average). Later statistical evaluation of the data confirmed differences between these two groups of pH therefore describes the largest concentrations of most metals and ions that occur in a pH between 7 and 8; When in low pH, Ca + 2, Mg essential + 2 and some micronutrients become scarce. Under acidic conditions, certain ions and toxic metals appear in larger levels, may cause nutritional problems to water supply (Rosborg et al., 2003).

We analyzed the main electrolytes for 36 samples of bottled mineral waters in natural sources of 5 Brazilian States. The lowest was pH 4.1 (Acai/BA) and the largest 9.35 (Serra Negra/SP). The pH correlated positively and significantly with Ca 2+, Mg 2+, Na+ and HCO3-. This positive correlation is due to increased alkalinity of these salts, with more than 70% of bicarbonate doing part of the molecule and the prevalence of same in the composition of the waters more alkaline (Rahaman et al, 1999).

The mineral waters pH values are thus grouped:

ANTIOXIDATIVE	**ANTIOX**	**>9.0**
ALKALINE	**ALK**	**8.0 a 8.9**
LIGHTLY ALKALINE	**alk**	**7.2 a 7.9**
NEUTRAL	**N**	**6.0 a 7.1**
ACID	**ac**	**<5.9**

For each group of range in pH, sought out evidence of potential bioactivity: Therapeutics (M), provided for in directives (LEG/BRA and LEG/WORLD), of interest or nutritional/dietary restriction on daily life (D) and by external applications or balneotherapy, using parameters executives reasoned in Japanese Onsen (B2).

Database query published as "Clinical Trial Controlled Clinical Trial and Review", with the keywords "mineral water" AND "pH" or "alkaline" on a specialized database, provided 12 http://www.ncbi.nlm.nih.gov/pubmed digital results.

8.1.1. pH Antioxidative (ANTIOX)

The solubility of proteins control various biological processes and their behaviors are closely related to the ions present in their structures and the substances with which they interact. Most aqueous solutions and biological life-related has little content of salts dissolved or low ionic strength. So, research on the effectiveness of the ions, jointly or individually, show that the solubility of proteins increases in low ionic strength solutions. Experiences with the lysozyme reveal that at pH 4.5 its solubility is strongly dependent on the solubility of anions and also that at pH 9.5 such solubility becomes independent of the ionic strength of the medium (Retailleau et al., 1997).

The daily consumption of water with a pH above 9.5 contributes directly and increases the ability of minerals in balance the excessive acidity increases with age and can be responsible for several diseases (Dawson-Hughes, 2009).

In sensory evaluation of bottled waters with calcium concentration above 10 mg/l induced pH (alkaline electrolyzed ") of 9.5 presented a taste more enjoyable (Koseki et al., 2007). So, this will be the minimum value of potential bioactivity in everyday consumption (DANTIOX).

Metabolic acidosis is a medical disorder characterized by a low pH in tissues of the body and blood, with a variety of neuromuscular and respiratory consequences. His treatment by the administration of sodium bicarbonate can bring undesirable side effects, such as sodium overload and congestive heart failure.

The use of hydrogen-rich waters or alkaline pH in food is new technique to combat acidosis, antioxidant and anti-aging, who seems to possess greater bioavailability and minor side effects. In this study, with water of pH 9.3 administered in diet for 7 days with 19 young, if notes that such benefits should be better researched on nutritional character (Ostojic, 2012).

Clinical evaluation for 4 weeks with two groups of 16 physical activities practitioners and individuals who consumed daily water alkalized "Alka-PlexLiquid" (pH = 10) and public drinking water (placebo, pH = 7) indicated, through blood test, significant profit differential acid-base balance and hydration conditions on group benefit nutritionally alkalized (Heil, 2010).

Participated in randomized clinical trial 45 women with lung cancer, which during 6 weeks ingested 250 ml of alkaline water (pH = 9) with 30 minutes before and 30 minutes after each section radiumtherapy indicated effectiveness (comparative placebo used) in the reduction of skin problems caused by exposure to radiation (Kunos, 2012).

And by this study be inscribed as "clinical trials" in the database of the National Institute of health of the United States (USNIH), its result is here adopted as potential bioactivity therapy for waters with strongly alkaline pH (MANTIOX).

On the arguments relating to health risks for excessive acidity in all physiological processes and the current nutritional option quote, where work alkalinizing stated that ingesting termed as alkaline waters ("alkaline antioxidant water"), with a pH above 9.5 is the best food source of OH-ions in quantity and bioavailability capable of neutralizing acid radicals quickly of the human organism (Whang, 2005).For the bioactivity of pH 9.0 in balneoterápica (BANTIOX) is Japanese for legislation revealed differentiate these two types of alkaline pH and be used by Onsen, philosophy grounded in baths (Michelan, 2000).

8.1.2. pH Alkaline (ALK)

Although some authors consider that the pH of mineral waters is not necessarily related to acidifying effect or alkalinizing the human body (Wynn et al., 2009), the alkaline waters, due to pH or mineral, has been considered as beneficial to human metabolism and potential prevention for chronic diseases (Kruse, 1927).

Several studies have been conducted on the effectiveness of alkaline diets and its health benefits, being recommended therapeutic agents with high pH (Schwalfenberg, 2012). Positive results began to appear in the prevention of chronic metabolic acidosis related issues, through the daily consumption of mineral waters (Vormann and Remer, 2008).

Metabolic acidosis can occur as a result of the accumulation of endogenous acids or loss of bicarbonate from the gastrointestinal tract and kidneys. Natural or ionized alkaline water can bring benefits to this problem. Waters with a pH between 8 and 8.9 were used in a study in animals through ingestion and in hemodialysis, being observed greater balance of acidosis and urinary diversion (Abol-Enein et al., 2009).

Studies on food intake in areas where the incidence of cancer is very low mostraramcoerência the requirements for the therapy of high pH value. Recognized as high pH therapy Brewer, has been developing as an alternative to cancer, which uses dietary values in this same proportion of alkalinity, with pH between 8 and 8.9 (Brewer, 1984). In this way, this range will be considered of potential bioactivity and therapeutic dietetics in alkaline pH (MALK).

Natural potable waters containing bicarbonate and pH above 8.8 can influence human pepsin and establish its potential for buffering. Thus, the consumption of these alkalizing water can bring therapeutic benefits for patients with reflux disease (Koufman and Johnston, 2012).

Are also taken as references balneotherapy (BALK) the similarities in policies for daBulgária and Serbian mineral waters, consisting as above the moderately alkaline pH of 8.5 (Fagundo et al., 2001; Kosic et al., 2011).

The alkaline environment eases puffiness and softens the epidermis and improves skin elasticity; Thus, it has positive effect on dermatological gynaecological various illnesses. This suggests the pH dependence (< 2.0 or > 8.0) on permeability of the skin, to a substance (Cephalexin) and may reflect the establishment of selective cutaneous permeability, depending on the lipolificidade and/or the ionic species diffusivity (Hatanaka et al., 1995).

8.1.3. pH Lightly Alkaline (alk)

Epidemiological studies have shown that the high pH of potable waters, in addition to greater concentration of silicon, decrease the risk of Alzheimer's disease related to the presence of aluminum (Gillette-Guyonnet et al., 2005).

Recent studies published in the medical literature consider the so-called alkaline diet can reduce morbidity and mortality due to chronic diseases, being food-related mineral waters acidic negative charge due to the presence of salts and pH more alkaline than most human tissues (Schwalfenberg, 2012).

Experiments on animals have shown that alkaline solutions may release stimulus to activate the gastric motor activity or prevent his inhibiting hormone secretion, improving thus the entire digestive process and assimilation of nutrients (Brown et al., 1973).

The variation of pH changes the degree of ionization of proteins and of many drugs. Like most ionized substances can't cross cell membranes easily, change in pH affect cellular functions and power of various pharmaceutical agents. For example, the relative acidity of the tissues in the vicinity of an abscess is recognized for reducing the efficacy of local anesthetics, while alkaline solutions tend to improve it. Alkalinity also potentiates drugs such as morphine and meperidine, increasing the availability of lipophilic base loaded not to cross the blood-brain barrier (Shulman et al., 1984).

The waters of the sources Tenryosui Hita (Japan) and Nordenau (Germany), with pH and pH 7.29 7.98, respectively have attracted the attention on health by enzymatic antioxidant activities strengthen and exert beneficial effects for various diseases, including diabetes mellitus. Being both classified as oligominerais because their levels of solid waste total approximately 150 mg/l (STD) and cold, maybe its similar pH is the property recommended for future research approach. Were also observed some pharmacological evidence in recent work in Japan (Li et al., 2012), being this interval here revealed as therapeutic potential bioactivity (Malk).

Alkaline water from the famous and sacred Zam Zam Source (Saudi Arabia), with a pH above 7.5 has historically been used for treatment and prevention of bone diseases and gastric, improving the capacity for aerobic activities and laundering toxins and acids of the body waste (Shomar, 2012).

The dietary consumption of public drinking water with pH less than 7.62 by children can increase the rate of development of diabetes type 1, when there are other risk factors. This statement results from survey of 230 individuals from Germany under 17 years (Winkler et al., 2008). This will be the value adopted here (Dalk).

Studies of drinking water (tap waters ") Norway's public associated the pH below 7.7 the existence of greater quantity of living micro-organisms, which, along with the presence or absence of other elements, showed high correlation in the occurrence of type 1 diabetes, especially in children (Stene et al., 2002).

Clinical analyses of groups with distinct prospective until 15 patients suffering from chronic venous ulcer in the leg, treated twice a week through skin grafts in specific pH showed clear effectiveness of up to 100% of cases when above pH 7.3 (Schneider et al., 2007). This will be the value adopted here (Balk).

A variation of pH to alkaline side gives rise to the hydration of the stratum corneum. Keratin gets soaked making it more permeable and at the same time more conducive to microbial development, such as fungi and bacteria (Barata, 2002).

8.1.4. pH Neutral (N)

Considering the importance and essentiality to the biological systems of simultaneous environmental presence of carbonates (CO2 and HCO3-) in the midst of specific pH, living beings possess different mechanisms to detect sensitive and which are saved or improved by any evolutionary process. This balance has functional expression in cell membranes, tissue associations with proteins and sensory transmissions. As well as the influence on the palate, are also studied their relationships with neurological problems, renal, endocrine and kidney, among others.

Due to some physiological activations metabolic significance of this system as a function of pH, in work of literature review concludes that some protein-coupled receptors "GPCRs" are inactive at pH 7.5 and > are fully activated at pH < 6.8 (Tresguerres et al., 2010).

In order to understand the influence of pH and temperature on intracellular regulatory mechanisms and permeation of power solutions and with the knowledge of pH of some tissues of human organs to 37 °C, as the skeletal (pH 6.89), heart (pH 6.92) in erythrocytes (pH 7.47) and the medium (pH 6.8), there were some experiments indicating that, for carbonated Ionic solutionsthe best pH for permeation of fabrics is 6.9 (Roos and Boron, 1981).

The predominance of natural reducing characteristics in human tissues and physiological fluids would be attributable to the latest geological conditions of Land, where the bodies were formed in anaerobic environments redutivos. Thus, it is assumed that plants and animals have such feature reductive as evolutionary process for protection against oxidative stress due to oxygen (or active oxygen) prevalent in photosynthetic aerobic medium. And despite this natural tendency to excessive and constant acidity, it is recommended to maintain balanced normal alkalinity of extracellular fluids, approximately 7.4 (Sherwood, 1994).

Such phenomena perhaps help explain the current daily consumption of the vast majority of food and beverages with a pH below 8. Through research in the waters of hot springs, its pH is suggested as desirable among weakly weakly basic acid, due to the potential for oxidation and reduction similar in human body fluids (Okouchi et al., 2002).

In an attempt to relieve some negative gastric effects after use of oral hygiene solutions, due to the high acidity (pH of 1 to 2); 5 products were assessed for subsequent neutralizing intake. It was observed that between a mineral water and a public drinking water (tap) with same pH 7, better results are expected from the first (bottled), probably due to greater concentration in salts of potential buffering, especially the bicarbonate (Lindquist et al., 2011).

Researching interactions between the secretion and motility in human stomach due to the infusion of solutions bicarbonated, experiment with 14 healthy volunteers showed that at neutral pH (between 5e 7) occurs the most complete absorption and organic recovery of HCO3-(Dalenback et al., 1995), being this average of pH 6 here selected as minimum parameter for this potential bioactivity in therapies and diets (nm and DN).

To evaluate differences between 3 brands of thermal waters of cosmetic threads uses, it is suggested that solutions with high pH or high concentration of mineral salts (STD) should not be used in dermatological disorders or in compromising situations therefore cutaneous barrier could cause stinging or discomfort (Nunes and Tamura, 2012).

However, some studies indicate that skin care products with low pH can affect the sensory reactions and reduce the acceptance of the patients (Lodén, 2003). This leads to the conclusion about the potential bioactivity in external display at neutral pH (BN), as well as the same value provided in Japanese legislation (Michelan, 2000). The maximum value for this neutrality is guided by the smallest value of alkalinity, limit this coincident to the Serbian law (pH 7.1) (Kosic et al., 2011).

8.1.5. pH Acid (ac)

Since the Decade of 60, the balneotherapy in thermal water, sulphated and with a pH of 3.8 SPA Sukawa in Iwate (Japan) are used in treatment of psychosomatic diseases related to disorders of the nervous and endocrine systems, due to the psychological stress (Suzuki and Yamauchi, 1973).

In experiment to evaluate the effect of external pH on the osmotic and Ionic permeability, fluid transport through the skin, were induced electrical currents in the skin of a frog bathed in salt solutions of 2 types, one with a pH 2.28 and another with 7.4 pH. The results obtained indicated that the solution of lower pH (2.28), the parameters of osmotic permeability and flow volume are almost 2 times higher than those of alkaline solution (pH 7.4), being then the acidity more recommended for pharmacological applications based on dermal penetration (Fischbarg and Whittembury, 1978).

A water acídula ("acidic antibacterial water") of pH 4.6 exhibited the following: action potential antibacterial, astringent, hygiene care, skin smoothness (similarity of pH), brightness of the hair, brush your teeth and removal of boards, in gargle (avoid with amalgams), cold sore, Podiatry, candidiasis, vaginal itching, against aerobic bacteria, cuts, blisters, abrasions or rashes, relief for mosquito bites or bee, eczema, dry skin and dermal cracks (Whang, 2005). Some authors suggest the use of farmacosméticos products with approximately pH 5.5 in treatments for skin diseases (Schmid-Wendtner and *Described*, 2006).

How were not found jobs related to hydropinic cure therapies (intake) in an acid medium, the values of potential therapeutic bioactivity will be the same as the balneotherapy, both limited by pH 5.9 considered here a minimum of neutrality (Mac and Bac).

To evaluate the pH of 10 brands of soft drinks and mineral waters of Brazil, was identified their risk factors for the development of dissolution in the enamel and dental surfaces injuries, being in the minority of the samples observed the satisfactory value of pH above 4.5 (Nakamura et al., 2010). So, this will be here considered the lowest pH value of positive everyday consumption bioactivity (Dac).

8.2. Total Dissolved Solids (TDS)

As liquid, water dipole is universal solvent and particularly conducive to diversified and simultaneous formation of ionic compounds and other substances also dipole (Hem, 1989). Many of these ingredients are essential to living things, with high natural Chemical equilibria and bioavailabilities when preserved constitute insurance and strategic access to these. Water and minerals are cited in pharmacopeias as nutriments (dietary supplements), chemical reference substances (SQR) (BRAZIL, 2010) and potential active pharmaceutical ingredients ("API active pharmaceutical ingredient") or of therapeutic activities such as traditional medicines (WHO, 2000).

The solids (salts) total dissolved (STD) in waters represent the combined organic and inorganic elements as dry residues after evaporation of a liter of water at 110°C or more commonly the 180 °C and so described their weights in this volume per unit (grams, milligrams or micrograms per liter).In natural waters, the STD is statistically related directly to pH, buffering, permanent or total hardness of inverse way to Langelier saturation index; and reasonably independent manner with the typology of its constituents (Kemp, 1971).

Are concentrations of total dissolved salts medium characteristics: waters of oceans (35500 mg/l), rivers (110 mg/l), rainy season (12 mg/l) and groundwater (469 mg/l). The dissolved constituents in groundwater may be exogenous or endogenous sources. When coming from the surface, their main source is the leaching of land involved to their cycles, biological phenomena, actions of hot springs (geysers) and the participation of the set of physical and chemical reactions as dissolution, hydrolysis, adsorption, ion exchange, diffusion, osmosis, evaporation, precipitation, acid-base balance, oxidation and reduction.

When the source is endogenous, their main source are magmatic and terrestrial phenomena (Shvartserv, 2008).The essential inorganic constituents of natural waters usually occur in the following descending order of levels: for AC, cations + 2, Mg + 2, Na +, and K + and anions, HCO3-, SO4-2, Cl-and NO3-2. In the waters of strong mineralization, the predominant cation is the Na + while the anions Cl-and SO4-2 prevail over the HCO3-(White, 2013).

Often, the analysis hidroquímicas, especially the field, the STD shall be calculated from the measurement of electric conductivity of water, which greatly depends on the total concentration of ions in solution, but is not sensitive to organic constituents, substances not soluble electrolytic Ionic as Si, B and Ti or dissolved gases. It also depends on the temperature (calibrated at 20°C), with differential sensitivity according to the Ionic types. Thus, an estimate can be made by multiplying the average electrical conductivity by a factor varying between 0.55 and 0.75 (Tölgyessy, 1993).

Aquifers in crystalline rocks have low STD, the schists changed a little more (especially Himself), Granites on average 200 mg/l of STD, with higher acidity and proportion of Na +/K +, alkali metals and dissolved CO2. The basalts are on average 500 mg/l of STD and more Si (20 to 40 mg/l) Granites.

Groundwater of sedimentary environments usually possess STD greater than those of crystalline limestone, are the smallest levels due to less dissolution of HCO3-that predominates on SO4-2 and Cl-. This lithology, when greater porosity, can increase the STD. In sandstones, the concentration tends to be little higher and increases as a function of depth of circulation, but the largest STD comes from clay sediments and evaporites, mainly margosos saline deposits and oilfields (Szikszay, 1993).

All international directives consulted have STD levels as parameters in the rankings of the fresh waters, potable and mineral or bottled. Before this, relative similarity is observed as regards types grouped: light or lightweight, oligominerais, lightly minerals, mineral, minerals or heavily medium "premium" isotonic, and hipersalinas. Also, the concept of mineral waters predominates in those with STD > 1000 mg/l.

This information, therefor the differentiations of the potential bioactivity of the BAC related to STD, whose selections of minimum values were evaluated individually in this work. The following frame with these descriptions:

BAC	**SÍMBOLO**	**mg/l**
STD Levíssima	**diet**	<50
STD Oligomineral	**OLIG**	51 a 310
STD Mediomineral	**MEIO**	311 a 1000
STD Mineral	**STD**	1001 a 7500
STD Isotônica	**ISTN**	7501 a 13000

Although many epidemiological studies associate the greatest concentration of STD in potable waters to increased occurrence of various diseases, others point inversely with mortality (WHO, 1993).

According to the Guidebook recommendations for drinking water of the World Health Organization, the amount of STD is 100 mg/l, the great being between 200 to 500 mg/l, the allowed between 500 to 1000 mg/l and the excessive above 1500 mg/l (WHO, 1980, 2005, 2008). These values are based on systematic reviews and extensive experimental studies carried out in several countries and by experts of this same international organization.

Randomized groups of rats, dogs and human volunteers ingested: public drinking water of the city of Moscow (Russia), dessanilizada water with 10 mg/l of STD, water prepared in laboratory with 50, 100, 250, 300, 500, 750, 1000 and 1500 mg/l STD; all containing the same proportion of Cl-(40%), HCO3-(32%), SO4-2 (28%), Na + (50%), Ca + 2 (38%) and Mg + 2 (12%).

The health outcomes variables were investigated: Dynamics of body weight, basal metabolism and nitrogen, enzyme activity, salt and water homeostasis of its regulatory system, mineral content of tissues and body fluids, hematocrit and activity of ADH. The assessment criteria used were: lower incidence of adverse effects, negative changes to humans, dogs or rats, good organoleptic characteristics, potential to quench thirst and low power of corrosion.

Although the drinking water, with rare exceptions, is not the primary food source of essential elements for human beings, their contribution can be important because:the world's increasing nutritional deficiency of several minerals and microelements are not offered by the modern diet or in poor communities;constitutes add-on option in special diets for vegetarians, lactating mothers, newborns, seniors, athletes and women; constitutes source of these ingredients with potential for absorption and bioavailability comparatively better than other foods, due to their ionic form free and naturally balanced.

Some experiments indicated a reduction of up to 6 times in some microelements contained in muscle tissue by replacing your water consumption for nutritional supplements of same composition (WHO, 2004).

The possible adverse consequences for water consumption below the minimum recommendation in the STD content in drinking water (< 100 mg/l) were also discussed by this same institution study groups in the following categories:the direct effects on the intestinal mucous membrane, metabolism and mineral homeostasis or other body functions; little or no intake of Ca 2 + and Mg 2 +;low intake of other essential elements and microelements; greater loss of Ca + 2, Mg + 2e other essential elements in prepared food; possible increased ingestion of toxic metals;possible bacterial contamination; abnormal increase diuresis (almost 20% above average), and may leach inappropriately essential nutrients (Na +, K +, Cl-, Ca 2 + and Mg + 2); water flow increase and serum concentration of body Na +.

One of the most evident bioactivity of different levels of STD in drinking water it's influence on your taste buds, being by some experts as described: tasteless when below 25 mg/l, excellent between 25 and 300 mg/l, well, between 300 and 600 mg/l, between 600 and 900 reasonable mg/l, weak between 900 and 1200 mg/l and unacceptable when greater than 1200 mg/l it is important to consider that the flavors are also very dependent on the types of these total dissolved constituents and other properties such as pH, impurities, gases and temperature (WHO, 2005).

Some authors consider that the tastes of mineral waters are mainly influenced, in this order: STD, hardness, bicarbonates, sulfates and pH. A summary is presented in the following table:

PROP/SAL/ION/GAS	**FORMA**	**SABOR**	**REF**
Cloreto de Sódio	$NaCl$	Salgado	Mourão, 1992
Oligomineral e O_2	STD,O_2	Insípida e inodora	Mourão, 1992
Gás Carbônico	CO_2	Adstringente, picante, acídula agradável	Mourão, 1992
Sulfatada	SO_4^{-2}	Amarga	Mourão, 1992
Ferruginosa	Fe total	Adstringente ou estíptica	Mourão, 1992
Sulfato de Zinco>4mg/l	$ZnSO_4$	Adstringente	WHO, 1993
Molibdato de amônia>10mg/l	Mo^{+2}	Ligeiramente adstringente	WHO, 1993
Sulfato de Sódio	Na_2SO_4	Ligeiramente salgado	Rey-Salgueiro et al., 2013
Bicarbonato de Sódio	$NaHCO_3$	Ligeiramente salgado e doce	Rey-Salgueiro et al., 2013
Carbonato de Sódio	Na_2CO_3	Amargo e salgado	Rey-Salgueiro et al., 2013
Cloreto de Cálcio	$CaCl_2$	Fortemente amargo	Rey-Salgueiro et al., 2013
Sulfato de Cálcio	$CaSO_4$	Ligeiramente amargo	Rey-Salgueiro et al., 2013
Sulfato de Magnésio	$MgSO_4$	Ligeiramente amargo em saturação	Rey-Salgueiro et al., 2013
Cloreto de Magnésio	$MgCl_2$	Amargo e doce	Rey-Salgueiro et al., 2013
Sódio	Na^+	Salgado, ácido, picante	ABS, 2010
Cálcio	Ca^{+2}	Meio adocicado	ABS, 2010

Magnésio	Mg^{+2}	Amargo, adstringente, fruta verde	ABS, 2010
Potássio e Manganês	K^{+} e Mn^{+2}	Ligeiramente salgado	ABS, 2010
Fe, Mn^{+2}, Cu^{+2}	Fe, Mn^{+2},Cu^{+2}	Metálico	khymos.org
Gás Sulfídrico	H_2S	Ovo podre	khymos.org
pH<4	Ácido	Ligeiramente azedo	khymos.org
pH>8,5	Básico	Ligeiramente desagradável	khymos.org
Ferro elevado	Fe	Oxidação ferruginosa	khymos.org
Temperatura	12,78	Ideal para degustação	khymos.org
pH 7,1 a 7,5	Neutro	Adocicada neutralidade	finewaters.org
pH 5 a 10	H	Contribui com apenas 5% do paladar	finewaters.org
Sais Totais Dissolvidos	STD	Contribui com 20% do paladar	finewaters.org
Gás Carbônico	CO_2	Contribui com 75% do paladar	finewaters.org

In the ranking with a total of 1461 bottled mineral water brands listed on the site www.mineralwaters.org, it can be observed that the average is around 877.4 mg/l and there are several bottled mineral waters in Europe and North America with STD very above 1000 mg/l (limit). National mineral waters, for the most part, have very low content of STD; the cited in the section highlight the flavor light and medium are among the minerals.

According to the evaluation study for installation of SPA complexes in Iraq, hydromineral fountains possessing levels of STD among 2225 mg/l and 6918 mg/l are part of the set of potentially favorable characteristics to balneológico interest, following the suggestion of the leading SPAs of the United States, Slovakia and Czech Republic (6000 mg/l < STD) (Al Dulaymie et al., 2011).

Although this type of classification being one of the few bioactive components here addressed to is not listed in the Brazilian Code of mineral waters of 1945, is recently proposed by group of specialized studies classes: high residue > 250 mg/l, average between 100 and 250 mg/l and low or oligominerais less than 100 mg/l (BRAZIL, 2002). Such quantification seem quite appropriate to the reality of Brazilian potted mineral waters where the average value of STD is in the order of 85 mg/l (100 mg/l <STD in more than 50% of the total).

For this reason, most ratings termed as crenotherapy (medical hydrology) are not related to their mineral constituents. Even that could be oligominerais are labelled on the basis of their radioactivity and temperature, which are consumable properties recommended only immediately in their own natural source of origin (Rebelo and Araújo, 1999).

Watching some forms of classifications which they regard as the waters with thermal temperature in 5°C above the average of the same locality source atmospheric hidromineral, perhaps many currently bottled mineral waters in Northern and northeastern Brazil would not receive such a designation.

As these same waters have an average of fairly low also pH (pH <6), their genetic explanations denote evident the shallow aquifers and hydrogeological associations with short cycle transit time, IE very similar and meteoric waters with the troubling feature of high natural vulnerability to contamination (Bertolo, 2006).

In the market for bottled mineral waters average STD in Europe exceeds 500 mg/l (Birke et al., 2010) and the Brazilian law limits the maximum STD for bottling at 1000 mg/l, thus making, this product uncompetitive against the similar bottled in other countries, as for example: Agua de Carabaña (Spain) with 86550 mg/l, Attiva (Italy) with 51120 mg/l, Bad Mergentheimer Albertquelle (Germany) with 42000 mg/l, Original Fountain Of Youth (United States) with 17349 mg/l, Donat (Slovenia) with 16870 mg/l and Abenakis (Canada) with 14300 mg/l STD.

Once the grounds for classification of our mineral waters, also submitted by the group of Brazilian studies, occur on the basis of scientific evidence of physiological activities, nutritional, pharmaceutical and/or therapeutic waters and their hydromineral fountains, perhaps inferred ratings fluoridated water, litinadas or vanádicas should be more research.

Database query published as "Clinical Trial, Journal Article and Review" with the words "mineral water" considered AND "total dissolved solids" or "TDS" in specialized digital database http://www.ncbi.nlm.nih.gov/pubmed provided 2 results.

And with the same keywords found at site specializes in scientific articles about medical treatments were obtained www.medify.com 485 studies to 80508 patients ("mineral water").

For "mineral water" AND "total dissolved solids" obtained 46 studies for patients and 1824 "mineral water" AND "SPA" reached 59 studies for 57129 patients seen. The main types of diseases are: rheumatic, digestive, musculoskeletal, renal, dermatological and chronics.

8.2.1. TDS Faintest (diet)

For definition of the maximum value of this BAC in 50 mg/l of STD or 77 µS/cm of electric conductivity (Van der Aa, 2003), STD related to natural waters few minerals or Gossamer (diet), which is also the minimum for the BAC following low mineral (OLIGO), followed by the directives: the France/1989 on their potable bottled natural mineral waters and on classification of very weakly mineralized (Popoff, 2010), European Community (I, 2009) on the exploitation of natural mineral waters as mineral water very weak, of the United States/2012 on amendment of the federal Act update on dietary supplements to health under the designation of water with low mineral content (USA, 1994) and also this same country the bottled water regulator code that styling the commonly known as spring waters, drinking or potable waters, who are the ones containing between 50 and 500 mg/l STD (USA, 2012).

Perhaps the best known and researched source of mineromedicinal water of this type is in of Loreto (Italy) with 14 mg/l STD, pH 5.8 and 11 mg/l of O2. There are extensive physiological and medical efficacy studies, by enumerating: significant increase in urine output and sodium excretion, promotion of exchanges, intracellular detoxification, combating uric acid, the risk of cardiovascular diseases, diabetes, obesity, chronic diseases, cellulite, reducing systolic blood, improves the edema of stasis, favouring the digestive function, use in nutrition and in the preparation of food for babiesIn addition to the production of homeopathic medicines (Landolfi, 2011).

Among the bibliographic citations of this thesis, describes the clinical trial conducted with 18 individuals presenting problems of constipation, cramping and constipation. Through daily applications of this water via ingestion and thermal colon cleansing in the short term, were solved 80% of the cases (Mazzocchi, 2007).

Several abstracts were found in Russian production (Kurortol Fizioter Vopr Lech) about this kind of water and its therapeutic effects, being interesting quote suggestion to assess jointly and colloidal organic substances in these waters less mineralized (Shimonko et al., 1987), as well as ionizing potential relationships when there is radioactivity in relation to the trace elements (Quote and Harley, 1913; Mourão, 1992; Sakoda et al., 2007).

For this reason, the analysis hidroquímicas with lower limit of detection in trace elements are of interest in biochemical, pharmacological research and in medicinal chemistry in relation to the extremely small total mineralization of waters, in front of the great Brazilian endowment.

The following are some analysis in parts per billion (ppb), performed in the lab in Braunschweig (Germany) Institute of Plant Nutrition and Soil Science-Federal Agricultural Research Center (FAL) ", where they were only selected samples with STD less than 50 mg/l, which were obtained on the website www.mineralwaters.org.

COUNTRY	SPRING	B	Mn	Fe	Cu	Zn	Mo	Al
DEU	Zevenwacht	16,58	4,48	18,96	1,65	9,98	0,07	
BEL	SPA	10,19	11,40	396,32	1,31	10,98	0,07	
BRA	**Ubá**	**55,84**	**3,73**	**16,09**	**3,64**	**6,40**	**0,04**	
ZAF	Simondium	15,27	1,26	141,80	4,79	11,40	0,53	
BRA	**Prata**	**11,60**	**2,38**	**67,81**	**0,69**	**5,6**	**7,3**	
DIN	Overberg	22,65	1,11	37,77	1,65	7,78	0,11	
UK	Old Postoffice Tree	26,50		30,00	0,63	1,34	0,07	
FIN	Normandie	18,64	1,82	136,36	31,5	8,31	0,31	
BRA	**Magna**	**22,73**	**4,93**	**26,03**	**3,79**	**6,00**	**0,12**	
ITA	Lurisia	6,99		42,61	3,65	38,02	0,10	
BRA	**Levíssima**	**12,12**	**1,98**	**60,70**	**6,94**	**7,60**	**0,25**	
ITA	La Vie	25,76	38,68	28,94	5,82	6,72	0,07	0,01
BRA	**Himalaia**	**9,96**	**5,25**	**8,84**	**2,84**	**7,54**	**0,06**	
UK	Golden Tulip	25,60	1,27	22,66	2,21	7,81	0,05	
AUT	Drakenstein	42,67	1,46	212,25	15,08	15,67	2,97	
ESP	Aquad'Or	30,27	28,58	12,51	1,35	3,40	0,05	

Bold = Outstanding

Knowing the relationship between Aquaporin-2 structure, the induction of water absorption by the body, urinary excretion, plasma osmolality, pressure in the blood vessels and hypertension, such analyses were performed on 2 groups of 10 healthy young people each, after 1 day consuming above the normal amount of STD, two types of different waters.

Thus, one can relate to water with low mineralization (6 mg/l of STD) a significant further reduction in the levels of urinary excretion of Aquaporin-2 in comparison to high water mineralization (1283 mg/l STD), long-term consumption can be important nutritional habit in the prevention of hypertension and cardiovascular diseases (Buemi et al., 2007).

With similar focus, pharmacological experiments took place related to urinary excretion over a mineral water with 1940 mg/l STD and other public drinking from the Aqueduct Aqua Marcia (Italy) with 57 mg/l of STD not being observed differences, if recommended daily consumption of slightly mineralised by unaware of the risks resulting from higher levels of bioactive elements dissolved in mineralas well as appropriate the indication described take dilution type of infant milk powder (Evandri et al., 2001).

Because of its characteristics, other authors also recommended bioavailabilities waters with less than 20 mg/l of STD as dietary source of microelements for small children (Rudzka-Kantoch and Weker, 2000). In addition to being able to be interesting for individuals with problems or propensity in the formation of kidney stones.

The clinical trial conducted with 20 volunteers consuming daily and during 2 weeks only one type of water every 10 group, one with less than 20 mg/l Ca + 2 and reduced mineralization and another with 370 mg/l Ca 2 +, bicarbonate and middle residue. This study resulted in the recommendation to ingest water with low mineralization between meals (Coen et al., 2001).

On the evidence of the large number of health benefits of diets with reduced consumption of salt, the recommendation with mineral waters minimum levels of sodium that, in most cases, also has reduced STD. However, even when the concentration of this element is little higher than the recommendations for less than 20 mg/l Na +, the waters do not offer the same risks to the dietfor this element be associated with other ions than the chloride (McCarty, 2004).

Solutions were tested with different STD in order to understand the influence of these concentrations in the phenomenon of ionic transport between two anionic exchange membranes. physical models demonstrated that the amount of transported ions should increase with the decrease in the concentration of the solution, in a linear fashion.

However, when in extremely low dilutions, as the water of a river used in this case with less than 1 mg/l of STD, occurs a strong and sudden fall in the rate carried, quite discrepant expected. The anomalous increase in electrical resistance of the membrane surrounded by such negligible waste solutions maybe deserves further research (Dlugolick et al., 2010).

With great interest the extremely diluted aqueous solutions (1 mg/l < STD), because some behaviors different physico-chemical to the theoretically expected in these concentrations and with little-known explanations (Elia and Niccoli, 1997). Through successive dilutions and agitations subsidiaries, were observed changes in natural features of these structural and permanent way solutions. Such phenomena are part of homeopathic philosophy which employs the "medicine without molecules" (Chaplin, 2003).

Thermodynamic studies provide interesting information about the behavior of solutes and their interactions with solvents. And recent experimental results reveal that despite the extreme dilutions, an exothermic excessive heat has been found in about 92% of the samples, as well as their electrical conductivity measures far superior to the control samples (Elia et al., 2004).

In order to demonstrate the potential correlation of bioactivity hidromineral with this medical specialty, illustrate the table below 13 natural waters with these uses in the United States and Canada (CAN, 2008).

Ingredientes naturais para saúde classificados como substância homeopática

#	Nome NHPID	ORIGEM DO MATERIAL
1	EHP_Adelheid squelle	Spring water
2	EHP_Bondonneau aqua	Water
3	EHP_Sanicula aqua	Mineral spring water
4	HPUS_Rock water	Water sourced from Sotwell, Wallingford (Inglaterra)
5	HPUS_Teplitz	Mineral water from the hot, alkaline springs of Teplice (Rep. Tcheca)
6	HPUS_Wiesbaden	Wiesbaden spring water
7	EHP_Carlsbad aqua	Spring water from the Sprudel and Muhlbrunnen springs
8	EHP_Aqua petra	Water from city of Petra
9	EHP_Franzensbad aqua	Water from springs of Franzensbad, Bohemia (Alemanha)
10	EHP_Gastein aqua	Water from springs of Wilbad, Gastein (Áustria)
11	EHP_Gettysburg aqua	Mineral spring water from Gettysburg Pa (EUA)
12	HPUS_Aqua marina	Sea water
13	Water chemical subst.	Destilada – Medicinal ou não

HPUS=Homeopathic Pharmacopoeia of United States; EHP=Encyclopedia of Homeopathic Pharmacopoeia

A total of 2018 hydromineral fountains for bottling in the world with STD values listed in the database expert, 200 brands are in this group (STD diet < 50 mg/l) (www.mineralwaters.org).

8.2.2. TDS Oligomineral (OLIG)

This kind of biologically active component also gives its name to a classification crenológica or being oligominerais waters Hydrochemistry provided for in laws of some countries when STD is less than 100 mg/l as mineral in food or between 50 and 500 mg/l as drinking bottled water (France and Spain), between 50 and 100 mg/l in Argentina and less than 200 mg/l in Cuba, Italy and Spain (when natural mineral) (Marotta and Sica, 1933; Mourão 1992; Fagundo et al., 2001).

In Brazil, the legislation provides for mineral waters as oligominerais when, despite not reaching the limits, are classified as minerals for the immediate, proven and uncontested attribution of drug action, should also be classified in accordance with one or more elements of his compositions as prevalent or worthy of note, as well as the ionics or substances that contain rare and noteworthy (iodadas waters, arseniadas, litinadas, etc.) (Brazil, 1945).

Medicinal actions sought for all 60 hydromineral fountains components present in this paper may be of particular interest in this typology due to the large number of its instances and the current shortage of research with such approaches in Brazil.

Therefore, as for the other BAC, for selecting the minimum value that may possess bioactivity in low mineral water (MOLIG) sought out evidence of therapeutic efficacies in waters of the composition more similar as possible (in this case, STD and pH), which are sourced from other places where they have published standardized clinical trials accepted by medline database, embase, isi web of knowledge, cochrane, Ecuador-network, comet, Consort, amed, cinahl, pubmed, science direct, web of science and medify (Falagas et al., 2009).

Within the range of values above international managers and with distinct content enough to the limit with the next typology of BAC averagely mineralized (middle), if you chose for this reference to municipalities of Source Evian (France). Being one of the most famous waters throughout the world and with numerous medical scientific research carried out, in addition to works on satisfaction of taste and quality standard (Preneuf, 1984), its pH is 7.2 and 309 mg/l in STD here adopted (MOLIG).

Randomized with 80 people, men and women over 50 years drinking a liter of water daily, in addition to the normal consumption of other liquids and during 42 days, provided evidence of the increase in skin hydration index (Mac-Mary et al., 2006). Comparative study with 3 brands of isotonic drinks for athletes with 8 volunteers suggested similar effectiveness in the restoration of body fluids and transfusions (Shirreffs et al., 2007). Another study in this focus with the water San Benedetto (Italy) with 274.8 mg/l STD and pH 7.7 advised against such use by deficiency of Na + (Del Coso et al., 2008).

Recent evaluations have indicated improves the State of hydration in pregnant women and lactating mothers (Teurnier, 2013).

Noting large numbers of examples around the world, where water sources are used in balneoterapias and oligominerais based SPA activities, extensive research was carried out in similar occurrences of South Korea. Through pharmacological tests specific to external applications, demonstrates the potential reduction of immune cytokines and inflammatory skin processes; with special emphasis to the results at the SPA of Yong-gung in Incheon-si Oncheon/Gangwha-Gun (South Korea) containing 306 mg/l STD and pH 8.1 (Hann, 1996; Lee et al., 2012).

With this same level of 307 mg/l STD and pH 8.7, the water of the hot spring of São Pedro do Sul (Portugal) showed, in pharmacological experiments, potential effects anti-irritants and other dermatological benefits by applications of external aerosols on the skin (Ferreira, 2008).

With slightly smaller content, 207 mg/l STD and pH 7.5, is also renowned French occurrence Avène SPA, which has perhaps the most successful cosmetic line thermal produced with water from its own source, motivating your choice here as the minimum amount of bioactivity in external uses (BOLIG).

In a study with 174 adults, children and 212 262 patients with psoriasis, through hydrotherapeutic treatments daily during 3 weeks, the effectiveness was proven by dermatological indexes measured physically on the skin until a year later. Also observed significant improvement in the quality of life of participants (Taieb et al., 2009). Its thermal water was evaluated clinically cosmetic in 20 patients with dermatitis (melasma) which did their face topical 10 times over 2 days in their own homes, via portable aerosol packing (Barolet et al., 2009).

In the village of Comano-Trentino (Italy) containing 190 mg/l STD and pH 7.2 pharmacological experiments were conducted with subjects where, through external applications, if evidenced recovery for skin diseases (Valli et al., 2000; Faga et al., 2012).

Experimental studies have shown that trace elements stimulate the migration of keratinocytes, and may collaborate in cell renewal. And in cosmecêuticas formulations contribute to the hyperopia and as adjuncts in dermatological treatments, with immediate topics effects (Nunes and Tamura, 2012).

The waters of the sources Tenryosui Hita (Japan) and Nordenau (Germany) with pH and pH 7.29 7.98, respectively, have attracted attention on health by enzymatic antioxidant activities strengthen and exert beneficial effects for various diseases, including diabetes mellitus. Both are known as oligominerais due to the content of 150 mg/l of STD, being cold and great application for ingestion (Li et al., 2012). With the large number of references found on thermo-mineral fountains of similar mineralization content, some described below, this will also be the minimum dietary bioactivity (DOLIG).

Efficacies were demonstrated by clinical trials in Calimanesi (Romania) for the treatment of kidney stones, through the daily intake and during 2 years of your water (Single et al., 2012). Similar studies have been conducted with low mineral water of Funtana Piscamu in Siete Fuentes (Italy) containing 115 mg/l STD and pH 7.4 and where a group of 20 people with kidney problems was compared to another with healthy individuals, including notably the improvements (Scarpa et al., 1991), as well as in Roccheta (Italy) with 177 mg/l STD and pH 7.5 (Trinchieri et al., 1999).

Experiments with rats have shown potential neurological activities and improves muscle tone, they ingested by a few days the water of Fuenteror in Gran Canaria (Spain) containing 234 mg/l STD and pH 6.9 (Navarro et al., 2012). By 1071 interview medicinal SPA goers hot spring of Lanjaron in Granada (Spain) containing 188 mg/l STD and pH 6.8, if found that even during the short stay, most of the elderly revealed better provision, greater diuresis and feeling of being hydrated (Maraver et al., 2012).

A comparison was made between 5 hydromineral fountains where waters are famous Spain SPA, microbiologically were analyzed samples with higher antibacterial activity in lower mineralization (170 mg/l of STD) and who also have higher radioactivity (Serrano et al., 2012). In the global market for bottled water is common the term "premium" be associated to those containing over 150 mg/l STD (Rebelo and Araújo, 1999).

As some Brazilian balneotherapy indications summarized: diuretic and able body Ionic modification improves processes of neuro-dermatitis, disqueratosis, rashes, etc. (Frangipani et al., 1995); complete list in ANNEX 8.CRENOTHERAPY INDICATIONS.

The mineralization, although it is important factor, is not the only one to be considered as mineromedicinal water. The theory of electrolytic dissociation applies mineral waters in its analytical study, in close liaison with physical determinations, alkalinity, pH, conductivity, resistivity, crioscopic point solution and ionization natural state modifications (Mourão, 1992).

8.2.3. TDS Medium Mineralized (MEIO)

Although most of the international policies of the medium-term average mineral water or minerals their quantification is between 500 and 1500 mg/l STD (Fagundo et al., 2001), due to lower average waste waters clear from sources currently known in Brazil (Caetano, 2005), the limits for potentially therapeutic bioactivity (MMEIO) adopted here will be more diluted and so similar to those of the Italian legislation with 200 to 1000 mg/l STD (Marotta and Sica, 1933), but with both the limits controlled by the most common classifications (Petraccia el al., 2006) low mineral and mineral (OLIG: 309 mg/l and STD: 1000 mg/l).

The water where the largest amount of publications on clinical trials conducted in the Health Resort Truskavets spring (Ukraine) with 450 mg/l STD, being 8 work since 1967 the treatments related to kidney stones and urologic general problems (Khokhlov, 1992).

Standardized clinical trials with 135 patients with renal calculations problems or colelitiases, included with concomitant gastritis, provided positive results through balneotherapy treatments, by ingestion and bath, the Uvinskaya spring water (Russia) with approximately 600 mg/l STD (Gorbunov and Tomarikisi, 2011). Another similar study, including 17 post-surgical patients of kidney stones and placebo group ingesting public tap water, presented effectiveness with notorious increased urine output (diuresis) through Serebryany Klyuch spring water (Russia) with 390 mg/l STD (Neĭmark and Davydov, 2003).

But the water used for this same kind of treatment and with the nearest minimum content provided in this BAC at Cerelia spring (Italy) with 372 mg/l STD and pH 7.4, where they assessed the inductions physiological functions: significant reduction in levels of serum uric acid, increased urinary excretion volume and pH, besides the excretion of citrate (Bertaccini and Borghesi, 2009).

And the waters with higher levels of STD, where the mention of mineral medium or even low mineral are Sangemini spring (Italy) containing 975 mg/l STD and pH 6.3 and, where study of ultrasonography in 9 volunteers for a few days ingested this water on alternate days as compared to group like with potable tap water demonstrated pharmacodynamic effects on bile secretion and excretion in the duodenum, of interest to stomach treatments and problems of colicistitis (Grassi et al., 2002). With this same water interesting research were carried out relating to crenotherapy and sports medicine, where applications are of interest: recovery of injuries, rheumatology, musculoskeletal, fatigue, stress, stomach problems, dermatological, bile and even metabolic insulin dependent sportsmen to aid (George et al., 1987; Grassi et al., 1990; Grassi et al., 1996).

In the popular Volzhanka spring in Undorovskĭ (Russia) containing 982 mg/l STD and where are installed health resort and rehabilitation center that, since 1960, treat and research their effectiveness in various diseases of the digestive system, urinary tract and metabolic (Pytel et al., 1999).

On Uliveto spring (Italy) containing 986 mg/l STD and pH 6, evaluated preclinical evaluation in animals with disorders in gastric functions and functional dyspepsia through crenotherapy during 30 days (Bertoni et al., 2002). Other similar studies were carried out in this font, but also for intestinal problems (Fornai et al., 2008) and hemorrhagic gastritis caused by alcohol (Nassini et al., 2010).

Through comprehensive epidemiological study using Cohort methodology in Ust-Ilim region (Russia), morbidity and low physical development rates were observed in 7658 adults, 562 children and 1582 pregnant women with their newborns, inhabiting two communities supplied by different drinking water sources of which more than 15 distint components were hydrochemistry analyses each spring.

Both these communities have similarities regarding eating habits, air quality, social conditions and residence time in the respective areas. Were quite evident the results beneficial to health, distinguished between these communities, such as: goiter incidence rates, hypertension, ischemic heart disease, gastric and duodenal ulcers, chronic gastritis, colicistite, nephritis, growth rate and infant mortality, occurrences of edema and anemia among pregnant women.

The STD content of waters considered minerals in this work is 385 mg/l STD (Fight, 1992). This will be the minimum value also adopted for potential nutritional bioactivity on medium mineralization (DMEIO).

Comprehensive statistical study standard dietary Cohort was made in France with 4 groups of 166 adults in a daily water consumption according to their distinct mineralization, providing as a result the average main minerals as important providers of essential nutritional elements such as Ca2+ and Mg+2 (Galan et al., 2002).

Unlike the very positive results obtained for supplementation of sportsmen by oligominerals waters, was standardized benchmarking between Acqua Lete mineral water spring (Italy) containing 878,4 mg/l STD (pH 6.1) and two others with less mineralization. Via ingestion by 88 amateur athletes after stress, mineral water Lete presented significant impact on restorative body moisturizing, decreased urine density and positive effect of your pH (Brancaccio et al., 2012).

The bioactivity with undeniable highlight of this type of component in natural waters (mineralization average total) is the assessment of your palate. All figures compiled in bibliography, including panelists and tongue, found themselves in this range of background concentration: 270, 300, 350, 400, 450 or 650 mg/l STD (WHO, 1980, 1993, 2008; Platikanov et al., 2013; Rey-Salgueiro et al., 2013).

As thermal cosmetic brand, where besides the SPA practices and uses its natural resources for therapeutic development of its products, dermatological medicinal research justifies the activities about La Roche Posay fountains (France). This water with 444 mg/l STD and pH 6.9, guide this choice of minimal bioactivity in potential external use (BMEIO).

One day sensory clinical trial was conducted with 36 women trained for this type of test, divided into groups to apply waters under topical nebulization (spray) facial, representing 4 important French brands, with different mineralization: 200, 400, 5000 and 11000 mg/l STD. By using analog scales to skincare factors like: blazing light freshness, softness, suppleness and comfort; were evident comparative advantages of those with minor STD and freshness led by mark in question (Bacle et al., 1999).

8.2.4. TDS Mineral (STD)

In many the glossaries, definition of mineral water is directly related to the amount of STD is more than 1000 mg/l (USGS, 2012) and in various international policy occurs the same (Messina et al., 1999; Popoff, 2010; Serbulea and

Payyappallimana, 2012). Countries with a tradition of using balneoterápico and where are relatively more common sources of saline waters, this is the content classified as of low mineralization (Ivanov and Nevraev, 1964; Vasylivna, 2008; Kosic et al., 2011).

Two studies on medical treatments related to various diseases of internal organs and urology are here highlighted by styling and low mineralization: Mirgorodska spring (Ukraine) containing 3000 mg/l STD (Babov et al., 1999) and the Tib-2 in Tibskoye (Russia) containing 2000 mg/l (Dzeranov et al., 2000), noting that both are bottled.

This component variable is one of the largest amount of articles found on all the bioactivity dealt with here (therapies, diets and baths). The minimum value is established near the upper limit of the component mediomineral mineralization (middle) and it seems natural that the average concentrations used increased following diet, therapy and bath (Sukenik et al., 1999).

Being the balneotherapy treatments of health through immersion in water temperatures above 20°C and STD greater than 1000 mg/l, can be found over 200 specialized publications in randomized controlled clinical trials (randomised controlled trials-RCTs "), being above 70% for rheumatic diseases and chronic pain (Falagas et al., 2009).

Were found several similar approaches stressing the minimum content of 1000 mg/l of STD for baths and main indication of proven effectiveness the rheumatological, but also suggesting to temperatures above the baths, hidroterápicas applications for SPA and crenotherapy hydropinic cure through drinking water or less mineralized ("drinking or tap waters") (Bender et al., 2005; Pittler et al., 2006).

For the decision on the minimum value of STD in mineral waters for potential bioactivity balneotherapy (BSTD), despite the recommendations made on Iraqi assessment for SPA (>2225 mg/l STD), SPA Association of the United States (>6000 mg/l STD) and the related European (>8500 mg/l STD), due to low mineralization national averages, sought to scientific evidence for therapies only by water immersion baths hydromineral fountains (ESPA, 2006; Al Dulaymie et al., 2011).

As a result selected, is the Alsóközpont spring (Hungary) containing 1949 mg/l STD, where through clinical trial comparison between this water, another of highest content and a tap, with 10 people each subject to sections with immersion baths, evidenced a reduction in activity of 4 enzymes: catalase, superoxide dismutase, glutathione peroxidase and malondialdeídeo protein. Has thus, bioactivity and antioxidant reducing free radicals (Bender et al., 2007).

In this same country, were found several publications about clinical trials balneotherapy as the medicinal water of the Hajduszoboszlo SPA (Hungary) containing 3348 mg/l STD and where comparative clinical trial with tap water, with 42 patients each, musculoskeletal disease, degenerative through 15 immersion baths (30 minutes) per month and during 3 consecutive months, showed clear effectiveness (Oláh et al., 2010).

Another clinical trial balneoterápico held in SPA health informed source, containing 2789 mg/l STD and pH 8.1, demonstrated efficacy to treatment for 15 days in patients with knee osteoarthritis, stressing that she was an excellent option to pharmacological treatments, due to the evident improvement in quality of life associated mainly to individuals and not tolerant to conventional remedies (Fioravanti et al., 2012).

Fármacoclínico randomized controlled study conducted with a distilled water and mineral water from La Léchère spring (France) containing 2965 mg/l STD and pH 7.8, demonstrated that through its topical use as facial aerosol occur on cutaneous microcirculation differentiated physiological effects of therapeutic interest dermatological (Carpentier et al., 2002).

Similar study at Saint Gervais spring (France) containing 4245 mg/l STD and pH 6.9, demonstrated decreased trend in dry skin, hydrophobic adjusting the pH of the skin, increased skin hydration and well-being by the sensation of freshness (Elkhyat et al., 2004).

Large number of works was carried out with various mineral waters sources from Essentuki region (Russia) containing over 1200 mg/l of STD. with lighter type, used for bottling and home to renowned resort SPA, study in 40 patients with non-alcoholic fatty liver disease, through associated intake baths, revealed efficacy of treatment associated with reduced insulin resistance (Fedorova et al., 2012). At higger mineralized water in the same region springs, other searches done through 3 sections of inhalation by 23 volunteers, revealed, by blood tests, stimuli in the secretion of hormones, metabolic reactions and in levels of insulin, glucose, hydrocortisone and aldosterone (Khinchagov et al., 1998).

A single 300 ml same water intake together a dose of ascorbic acid, glucose and rutin remedie demonstrated a hyperglycemic vitamins reduction effect, improves metabolic levels related to diabetes and potentiation of the benefits of pharmaceutical substances, as indicated the blood test in 336 guinea pigs and 80 patients with type 1 and 2 diabetes. And the same pharmacological evaluations with duration of 24 days in guinea pigs have confirmed a significant elevation of blood levels of hydrocortisone, insulin and thyroxine (Polushina et al., 1997, 2000).

Regarding crenotherapy hydropinic cure (by ingestion), with the lowest levels near the minimum threshold of STD's in Donata mineral spring from Pisa (Italy) containing 1040 mg/l STD and pH 6.4 and where its effectiveness was evaluated for treatment of dyspepsia and biliary disquinesia in random study 2 weeks with 10 volunteers (Bellini et al., 1995).

In the famous Acqua Santa di Chianciano fountain (Italy) containing 3398 mg/l STD and pH 6.82, pharmacological research has been described between 2 groups with 12 healthy people, being one of comparison for different water consumption with low STD (low mineral), where they were differentiated benefits on the gallbladder motility (Graziani et al., 1994).

Numerous other similar clinical work were executed on this water applications in the treatment of functional dyspepsy, irritable bowel syndrome, chronic constipation primitive, among other gastrointestinal problems (Fraioli et al., 2010).

At work "the biological activity functioning by a mineral water from health resort spring elaborated for hydropinic cure" pharmacological trials were held for 24 days in subjects ingesting mineral water from Pitoniakówka spring in Szczawnica (Poland) containing 1200 mg/l STD with the results, some therapeutic indications could be suggested for future medical research, as well as certain restrictions in daily consumption (Drobnik and Latour, 2001).

Clinical evaluation of 4 weeks with 2 groups of 93 volunteers, a drinking spring water Staatliche in Fachingen (Germany) containing 2711 mg/l STD and pH 5.8 and the other with Germany's public drinking water containing 250 mg/l for STD and pH 7, it was observed that the superficial skin pH remained at the level considered physiologically optimal pH 5.5; while in public water consumption this value decreased significantly, even this possessing higher pH. The results of this work are concordant to several others cited, where the beneficial effects on the skin are related to water consumption with higher mineralization (including the sea), emphasizing the greater bioavailability and absorption power of essential nutrients when electrolytes in water (Williams et al., 2007).

European legislation classifies as waters rich in minerals those over 1500 mg/l STD (I, 2009) and although clear preference to the palate by mineral waters with low mineralization, there are groups of connoisseurs to the levels above 1000 mg/l STD (Platikanov et al., 2013), and can its flavor be compared to more full-bodied wines (www.finewaters.com).

Recent Polish article reports that despite the drinking water does not represent more than 8% of the total required for nutritional minerals, daily consumption of mineralized waters (1500 mg/l STD) should be encouraged, aiming at additional supplementation or even correct deficiencies of essential elements like Mg2+, Ca2+, F-, Si and trace elements (Drywień and Nadolna, 2012).

Due to its greater bioavailability than from other foods, these types of waters can be dieteticamente important, especially for children and the elderly (Rudzka-Kantoch and Weker, 2000).

Scientific opinion of the panel on dietetic products, nutrition and allergies in Europe recommends regular consumption of bottled mineral water from Melgaço spring (Portugal) containing 1132 mg/l STD and pH 5.9, for the reduction of bodily levels of hyperglycemia and thus the risks to diabetes type 2 (EFSA, 2009).

Despite the lack of bottled mineral waters in Brazil with this component content (STD >1000 mg/l) due to legal restriction and on of the above, it is suggested the maximum potential bioactivity nutrition (DSTD) at 1500 mg/l for STD.

Noting that for these waters there are several possible applications for health, how the bottled water from Vichy Célestines spring (France) containing 3378 mg/l STD, pH 6.8 and has recommendations for correction of losses of electrolytes due to physical exercises and sports practices (Queneau and Hubert, 2009).

8.2.5. TDS Isotonic (ISTN)

The osmotic pressure of a water is related to the amount and types of dissolved ions and is usually measured as a function of their relegation crioscópico, which in this case is equal to 0.55/°C. Their values are usually in molar concentration per litre (mmol/l) and when they are between 300 and 325 mmol/l, corresponding to the osmotic pressure of the blood serum are called post natal isotonic solutions; for some authors, can equate to 13000 mg/l in natural mineral waters (Fagundo et al., 2001).

By the classification provided for in Japanese policy, based on philosophy Onsen, isotonic mineral waters have between 8000 and 10000 mg/l STD (Japan, 1948). In a segment in which the isotonia is very well known, the food for athletes, the Brazilian correlate legislation considers the products ready for consumption with osmolality between 270 and 330 mOsm/kg (BRAZIL, 2010).

However, your daily consumption is not recommended in any scientific work consulted and therefore can't get values in bioactivity nutricial (DISTN). And even among the 47 bottled water brands found at the website www.mineralwaters.org, with levels of STD in this range, with 30 of them in the region of Essentuki (Russia), its related bibliography does not contain this type of indication in diet, even for the renowned Borjomi (Georgia), Polyana (Ukraine), Saratica (Czech Republic) and Aguas Verdes (Spain).

Statistical evaluation in Poland, 1384 with patients undergoing washing the alimentary canal, through the intake of isotonic mineral water containing 9750 mg/l STD unveiled immediate improvement in half of the cases (Zavadiak, 1999). Pharmacological studies have shown that the intake of water (bottled, too) of the font Tettuccio in Montecatini (Italy) containing 8342 mg/l STD causes a rapid and severe gallbladder contraction, being able to, after 2 weeks of treatment, benefit patients with dyspepsia (Foschi and Arena, 1990).

One of the best-known brands in the segment of cosmetics, thermal is Uriage (France), which produces all its products with water from its source, as well as conducts large number of research into the potential therapeutic effects of isotonic water containing 11000 mg/l STD (Bacle et al., 1999). Its applications in allergic diseases like asthma, rhinitis and atopic dermatitis were tested through short-term topical applications, with promising results (Beauvais et al., 1998).

With the spring water in Lacco Ameno Ischia (Italy) containing 11114 mg/l STD, comparative clinical trial was carried out during 3 months, with 15 days of applications each, via aerosol inhalation in 40 children with allergic rhinitis. With another group the same, using same technique hidroterápica with saline, additional benefits were observed, especially in the reduction of nasal symptoms (Del Giudice et al., 2011).

Before this, the selected values of potential bioactivity in baths (BISTN) and therapeutic applications (MISTN) covering the period between 7500 and 13000 mg/l for STD.In the database compiled in this work with Brazilian hydromineral fountains

(SPRINGS BRASIL), only four samples have residue total (STD) enough to this framework classification (Piratininga/SP, Cachoeira Dourada, Goiás, Nhecolandia/MS and Antônio Gonçalves/BA), although they are contained above 60 bottled water with such related features on the site www.mineralwaters.org.

Additional information about isotonic waters listed in: Schultz (1977), Swanson (1977), Pedley and Fischbarg (1980), Hill (1980), Reuss et al. (1991), Auler Jr et al. (1992), Vargas et al. (1993), Lim et al. (2000), Tabary et al. (2001); Dumas et al. (2007).

8.2.6. TDS Hypertonic (TALS)

Hypertonic waters are here considered as residue above 13000 mg/l STD and from hydromineral fountains. Other natural occurrences are the oceans (and inland seas) or salt lakes, corresponding to 97.61% and 0.008% of global water resources, respectively. The total surface water from rivers and lakes candy covers almost equal proportion (0.009%), but most of the terrestrial lakes are salty and the Caspian Sea, containing 11000 mg/l STD, represents 70% of saline water (Williams, 1996).

Among more than 50 salt lakes compiled from everyone, the less total mineralization found is 3000 and the biggest 380000 mg/l STD on Dabuxun lake in Qinghai (China), and styling of hipersalinas waters, when concentrated in more than 100000 mg/l STD (Oren et al., 2009). The second highest content in Brine of Guantánamo (Cuba) containing 347000 mg/l STD is cited as water mother (term used by producers of salt), where treatments are carried out in rheumatology, dermatology and endocrinology (Gomez et al., 2005).

In Brazil, some examples occur in: Lagoa Salgada/Rn, Feira de Santana/BA, Nhecolândia/MS, Araruama and Cabo São Tomé/RJ.

The most famous occurrence of this type is the dead sea (Israel) located at 417 meters below sea level and with water containing 330000 mg/l STD, where balneotherapy and climotherapy are applied jointly in treatments for dermatological diseases, rheumatological and asthmatic, among others (Sukenik et al., 1990; Sukenik et al., 1995; Shani et al., 1997; Gambichler et al., 2001; Matz et al., 2003). Getting thousands of visitors annually and supporting dozens of cosmetics manufacturers, in this set of natural therapeutic resources is the largest number of scientific publications with clinical trials and pharmacists about its health benefits

(Katz et al., 2012). Only in a specialized site listed more than 200 bibliographic citations (http://www.deadsea-health.org).

In studies related to the consumption in irrigation, industry and public water supply, groundwater is considered saline with mineralization already above 1000 mg/l for STD. Most of these aquifers is known up to 500 meters deep and its full of instances corresponds to the substrate of 16% of the Earth's continental area. The origins of salinity can be: superficial and shallow groundwater evaporation in arid climate, dissolution of salts from the surface, in salines zones, tectonic activity sedimentary deposits evaporíticos, fume in juvenile water or other products of original composition and terrestrial igneous origins (Van Weert et al., 2009).

Despite the Brazil water wealth, these types of aquifers do not reach 10% of the global contribution. Of the 333 main bodies of groundwater are listed only the conated saline basins of the Paraná and Amazon in part of its territory. It is noteworthy too, like IGRAC report (International Groundwater Resources Assessment Centre), the suggestion for the opportunities of its uses for health, tourism, wellness and bottling.

The highest mineralization found in groundwater sources used in SPA are in Salies de Beárn (France) containing 297892 mg/l for STD and showing termalidade. The balneotherapy and climatotherapy associated, in weekly visits for a year, showed 60% effectiveness in cases of chronic psoriasis, in addition to the general improvement in the quality of life of patients and with lower costs than conventional therapies (Léauté-Labrèze et al., 2001).

Some sulphurous hot springs near to the Dead Sea, as Snow Zohar (Israel) containing 215626 mg/l STD, 12.1 mg/l of H2S, 32.3 °C and pH 5.1, are used in the balneotherapy (Sukenik et al., 1999) and through their intake were evaluated clinical efficacies in patients with atopic eczema (Williams et al., 2012).

The bottled mineral water with the highest mineralization observed comes from Carabaña spring (Spain) containing 86550 mg/l STD, which, unlike previous ones, it is not sodium chlorine but a sulfated type. It began to be used as medicine, Pharmacopoea laid on since the XIX century, against tuberculosis and evident laxative effect, a facilitator of digestion, tonifying, depurative and against hangover, in external superficial cutaneous circulation increases usage and g anti-grease and seborrhea (Raynal and Lefebvre, 2011). Can also decrease cardiovascular risks in postmenopausal women, through controlled use (Schoppen et al., 2004).

Most bottled mineral waters with content of STD above 13000 mg/l STD found, are sodium chlorine or sulfated type; being the exceptions sprins with a predominance of bicarbonate: Cigelka in Bardejov (Slovakia) containing 29284.4 mg/l, Zuber (Poland) with 23895 mg/l STD, Donat (Slovenia) with 16870 mg/l STD and Essentuki-17 (Russia) containing 15900 mg/l STD (Sullivan et al., 2005; Diduch et al., 2011).

The radioactive termal medicinal water from La Toja spring in Pontevedra (Spain) containing 30000 mg/l STD and sodium chlorine type, is used in the long-term treatment of psoriasis and atopic dermatitis (Arribas et al., 2012).

The Italian region of Montecatini, the Leopoldine SPA health Source containing 24180 mg/l STD has publications of clinical trials on the efficacy of their treatments long-term balneotherapy for psoriasis (Tsoureli-Nikita et al., 2002).

For bottled mineral water Acqua source Regina containing 17295 mg/l STD, there are clinical trials showing effectiveness in patients with chronic dyspepsia after conventional crenotherapy 3 weeks (Bortolotti et al., 1999; Anti et al., 2004). Also features success in reducing LDL cholesterol after 3 weeks of treatment crenoterápico hidropínico (Caudarella et al., 1996).

The waters of the oceans are also higher natural resources endowment and diversity of biologically active components. On average, its salinity is 35700 mg/l STD, containing all the natural elements and physico-chemical properties that underlie the main theories and models for aqueous solutions in general (Tölgyessy, 1993).

The use of hypersaline solutions on improvement of infections is very old practice (Neal and Raleigh, 1930), its hot baths or local body immersion, as well as possess proven germicidal action compresses and healing of wounds (Lowthian and Oke, 1993).

The controlled intake of seawater from demonstrating effectiveness through clinical trials for chronic dermatitis and eczema (Hataguchi et al., 2005), improves renal circulation (Isetta, 2007), physiological re-establishment after serious injuries or surgeries (Huang et al., 2006) and recovery of respiratory functions in bronchitis, for inhalations (Nicolson et al., 2012). Thus, there are various pharmaceuticals having as basic ingredient to "Maris Aqua", for example: Plasma de Quinton, Sterimar, Otomer, Audispray, etc.

There are many balneotherapy applications in ocean waters, and can cite evidence in the treatment of cardiovascular diseases (Klemenkov et al., 1999) or as is very common, in rheumatology, where Brazilian clinical trial on Ponta Negra Beach-Natal/RN, with 46 patients with fibromyalgia have used your water and climate during 12 weeks, showing positive results (Andrade et al., 2008). These same authors suggest more similar publications in Brazil, due to its very effectiveness research in other countries, the lower costs to the comparative of other therapies and the accessibility of large part of the population, most of the year to the vast existing coastline.

The use of coastal natural resources in health benefits is called as Thalassotherapy and, in addition to the salty waters, also include climates of beaches, sea spray, mud, algae, sand and monazite. Are also in great number the references on this topic (Mourão, 1998; Charlier and Chaineux 2009).

Perhaps the best illustration about the scope and evolution of this segment is in realization of the International Congress on SPA therapies with saline water in health resorts, with dozens of published works in his annals (Falkenbach et al., 2010).

8.3. Hardness (Dur)

Water hardness is the traditional measure of its ability to react with soap and reduce its ability to produce foam. This feature is related to the presence of carbonate, bicarbonate, calcium, and magnesium, being smaller contributors barium, iron, manganese, strontium and zinc. Its origin is related to the dissolution of these intemperism ions, especially present in sedimentary limestone, dolomitic and gipsite (WHO, 1993).

Hardness measurement corresponds to the sum of moles of its two major cations (Ca^{2+} and Mg^{2+}) and anions (CO_3^{-2} and HCO_3^-), being temporary. Less frequent is the Association of sulphate anions, chloride or nitrate, which features permanent hardness (Brezonik and Arnold, 2011). The sum of these two types results in the total hardness, which can be expressed in mg/l or meq/l of $CaCO_3$, French, German and English degrees. The conversion factors for 1 mg/l of $CaCO_3$ are: 0.4 mg/l Ca^{+2}; 0.1 degree French; 0.056 degree German and 0.07 degree English.

The average values observed among 334 public drinking water from different localities of the United States, reveal that half have between 17 and 120 mg/l CaCO3 and half above this, occurring in anomalous samples 7 levels above 1120 mg/l of CaCO3. Comparisons on incidence rates for various diseases in these same locations were not conclusive, but despite several other variables not identified, suspicion of forming kidney stones due to hard water consumption has not been confirmed (Sierakowski et al., 1979). More recent studies have shown that, on the contrary, there is a negative correlation between such phenomena, and the presence of magnesium can be considered protective or therapeutic factor against renal calculi (Basiri's profile is et al., 2011).

The entire bibliography found on the influence of water hardness on health is related to its long-term effect on the everyday consumption. Over a hundred epidemiological observational studies have been published since 1957, when the first daily intake correlates of drinking water hard with the low rates of heart problems from their communities consumers. For therapeutic uses, i.e. with defined time interval and short or medium term, waters with high hardness can be indicated and should be researched (WHO, 2005).

So, for the selection of the minimum content of this type of potential biological activity, taking as a reference an experiment conducted in Guinea Pigs through their intake during 12 weeks. Comparing to another group of test subjects who consumed distilled water, concentrations of bad cholesterol (total, LDL and VLDL) were lower and cholesterol (HDL) higher for the group with hard water, also noting improvement in calcium balance in the digestive process (Porter et al., 1988). The minimum value in question (MDUR) is 500 mg/l of CaCO3.

Beneficial biological activity on external uses hard water (BDUR) is quoted by potential antibacterial and g anti-grease related to thin film lisa formed on the skin and hair in the baths (Skipton and Dvorak, 2009). Baths in hard waters produce maceration of epidermal cells, assists in the removal of substances excreted and decrease the oiliness of the skin and hair (Mourão, 1992). Often, for public distribution, are treated for hardness removal, and may thus cause skin problems. The value considered minimum for water hardness is 120 mg/l of CaCO3 (WHO, 2005).

Of the numerous articles consulted, about half does not complete on correlations of epidemiology of hard water with cardiovascular diseases (Ferrándiz et al., 2004). Also, despite suggestions of its benefits in other health problems like stroke, arteriosclerosis, hypertension, cancer and even aging (Masironi and Shaper, 1981), no conclusive research are observed.

Many recent works have been demonstrating predominantly these benefits to its magnesium content, more than calcium and related to the hardness of the water (Catling et al., 2008; Leurs et al., 2010; Basiri's profile is et al., 2011). To check the minimum value for any bioactivity in everyday consumption of hard water (DDUR) using evaluation performed in more than 18000 adults from Finland, for 3 years, where the group that consumed public drinking water with of 92.85 mg/l CaCO3, showed lower incidence of myocardial infarcts than other groups and the other regions of the country (Kousa et al., 2004).

The hard drinking water contribute typically with 5% to 20% of daily human consumption of calcium and magnesium (WHO, 2003). Despite major international institutions not quoting health risks by eating hard waters under any concentration, rare are the works found on such adversity and how your palate is acceptably affected by this, it is suggested as a maximum hardness in drinking water 500 mg/l CaCO3, predicted by several directives, including Brazil (BRAZIL, 2000; WHO, 2003). And this also is selected here as upper bound on bioactivity dietetics (DDUR).

This bioactivity range also includes dietary recommendations to avoid deficiencies related to 250 mg/l of CaCO3 (WHO, 2005) and gustatory satisfaction parameters for acceptable mineral waters for Taiwan consumers, between 150 and 250 mg/l of CaCO3 (Lou et al., 2007).

Database query published as "Clinical Trial, Journal Article and Review" with the key words "mineral water" AND "hardness" in the specialized database http://www.ncbi.nlm.nih.gov/pubmed provided 14 results.

8.4. Silicon (Si)

The average concentration of Silicon in igneous rocks is 281500 ppm in schist soils 330000 73000 ppm, ppm, in waters of oceans 2.9 mg/l, mg/l 5.64 rivers and in groundwater 8.4 mg/l (Hem, 1989; Shvartserv, 2008). In most waters, excluding the strongly alkaline, the predominant species of Itself occurs as ortossilícico acid (H4SiO4) and more rarely as metassilícico acid (H2SiO3). The colloidal form and Ionic not usually predominate, especially if there is organic matter in the water. This element has little correlation with the total residue (STD) (IOM, 2001).The conversion factors of Silicon compounds are: 1 mg/l SiO_2 = 0.47 mg/l Si = 1.3 mg/l H_2SiO_3.

Although Silicon is not listed in the laws of Brazil and Europe, mineral waters are classified according to the minimum content of this element in policies: Japan and Russia with 18 mg/l Si, Poland with 25.3 mg/l Si and Cuba with 14.5 mg/l. For consideration of its minimum value of potential biological activity in therapeutic applications (MSi) were compiled works where silicate waters demonstrate medicinal effectiveness. The mineral water from the Source in Trenčianske Teplice (Czech Republic) owns 18.9 mg/l, with lipid peroxidation inhibitor effect, observed in vitro. This could mean in the long term, antioxidant property (Durfinová et al., 2010).

In renowned cities French SPAs with silicate waters or siliceous, approximate levels occur 35 mg/l Si along with other important elements, which are indicated in the treatment of cardiovascular diseases, rheumatic, gynaecological and dermatological (Bains-les-Bains, Barbotan-les Thermes, Luxeuil-les-Bains, Neyrac-les-Bains) (Lacroix and Aboyans, 2005).

Study of mineral water from the Source Tersinka (Russia) indicates therapeutic activity with 37 mg/l Si, through applications via aerosol inhalation in patients with clinical symptoms of airway inflammation, nasal secretion, chronic bronchitis and bronchial asthma (Smirnova et al., 2003).

Via ingestion of silicate waters with 37 mg/l Si Tersinskoe source in Kuznetsk (Russia) (Kopylova et al., 2011), were noted in the liver changes adaptive structural at the cellular level and sub cellular, as well as changes of cellular bio-fase, concerning the sizes and quantities of their ultra structural joints (Korolev and Panova, 1994).

Silica is essential mineral component and one of the largest energizing nutrients in the human body. Reduces the risk of heart disease, prevents osteoporosis, aids in tissue repair, serving as an antioxidant and strengthening hair and nails. Clinical screening test documented by the FDA (http://clinicaltrials.gov) demonstrates that the silicate waters of Fiji (Japan) with 39.7 mg/l Si, can be indicated in ingestion and baths for bone diseases, Musculoskeletal and metabolic disorders, in particular, for women (Li et al., 2010).

Silicate waters with levels above 25.3 mg/l is recommended in balneoterapias, especially for the elderly, with topical anti-inflammatory action and silicic acid adsorption eyeshadow, being recognized their benefits applied in skin diseases

(Vasylivna, 2008). In Brazil, this type of use is also described by the sedative and emollient, of interest in pruritic skin diseases (Frangipani et al., 1995).

The notorious embelezadoras properties in cosmetic applications of Source waters Red Springs in Saratoga (United States) are known for decades. Among the explanations are the need and rapid skin absorption of silicon, associated with thin film formed by colloidal components of monossilícico acid present in these waters.

With an average of 27.3 mg/l Si, also are used externally in inhalations and as eye drops (Baudisch, 1943; Cole, 1983).

However, due to the high levels observed in the Brazilian samples here obtained, the choice of minimum value for potential bioactive Silicon external exhibitions (BSi) is restrictive only to equivalent results to the maximum concentration suggested by definitions of SPAs guides United States, 45.1 mg/l Si (Lund, 2000).

Epidemiological study conducted with more than seven thousand elderly women from five different regions of France, during 7 years of daily intake of his drinking water, assessed the environmental risk factor relating to Alzheimer's disease with different concentrations of aluminum, calcium and silica. Few coincidences statistics were observed for aluminum and calcium, but for silica observed positive correlation with improves cognitive performance. Exposure to drinking water whose concentration was greater than 11.25 mg/l Si indicated a lower rate of occurrence of Alzheimer's disease (Gillette-Guyonnet et al., 2005).

Subsequent studies confirm this feature with the same minimum content of 11.25 mg/l Itself, without, however, indicate inverse correlation or silicon with protective aluminium (Rondeau et al., 2009; Sunday et al., 2011). So, this is the minimum amount regarded as potential for biological activity of Silicon in diet (DSi).

Sudetes mountains (Poland) occur several sources considered curative water explored by leading SPAs. Study focusing on their levels of silicon and aluminum tried to demonstrate the exclusion mechanism of aluminum toxicity on the bioavailability of silicon, with the ability to reduce gastrointestinal absorption and increased excretion of the first; the highest content was in the well K-200 SPA Kudowa with 43.5 mg/l Si (Dobrzyński and Exley, 2010). Aluminum toxicity was also reduced by the ability of silicon to prevent changes of neurons, as pharmacological tests (Foglio et al., 2012).

Experiences in subjects treated with mineral drinking water, with a special combination of zinc and silicon, indicated significant increase in resistance of the

Sertoli cells and the development of adaptive and protective reactions (Korolev et al., 2012).In their public drinking water concentrations have varied between 0.2 and 14 mg/l, one of the 100 largest cities in the United States (7.1 average concentration mg/l Si).

Hydromineral source waters of Europe vary between 4 and 16 mg/l. The average of 14 mg/l was calculated among 270 bottled mineral waters of Italy. The largest values tend to be associated with volcanic hot springs, which may exceed 100 mg/l (Jugdaohsingh, 2007).

U.s. regions where potable water is hard and has 15 mg/l, present a lower rate of mortality due to coronary disease and heart problems compared to others where this content is less than 8 mg/l (Masironi and Shaper, 1981).

The dietary recommendation of this essential element is between 35 to 45 mg/day and its deficiency symptoms can be noted below this. Potable waters have Silicon in the form of better bioavailability for human consumption (50 to 86%) and typically contribute at least 20% of your total daily consumption (Duflot, 2007).

Since the 16th century, are found quotes on its benefits for the heart, eyes, lungs, kidneys, weak bones, relief of arthritis, rheumatism and even to compensate for damage caused by excessive alcohol consumption. In internal or external exposure, are evident their dermatological benefits (Scheer, 1997). Its main indications were compiled (ANNEX TABLE CRENOTHERAPY INDICATIONS), being some summarized:

• Improves cellular metabolism and stimulates the formation of cells

• Inhibits the aging process of Si in the tissues (cutaneous, connective, vascular, capillary, cuticular, etc.)

• Supplements impoverished tissues quickly with age

• Strengthens the connective tissue structure and function

• Increases the elasticity and firmness of the blood vessels, prevents aterioslerose and mitigates their effects (bloating ateriosclerótico)

• Promotes anti-inflammatory and anti-infectious reactions

• Stimulates the immune system to fight diseases caused by bacteria, viruses and toxins.

Queries the database for standardized clinical trials about the Silicon results in micronutrient studies 46 (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review", with the keywords "mineral water" AND "silicon" in the specialized digital database http://www.ncbi.nlm.nih.gov/pubmed, provided 24 results.

CHAPTER 9
ELECTROLYTES MACROELEMENTS

9.1. Main Anions

Ions are negative charges common in almost all natural waters and predominant concentrations to other dissolved anions, which are among mg/l and g/l. in this work, the following are approached the chloride (Cl-), bicarbonate (HCO3-) and sulphate (SO4-2). And may suggest to future research the inclusion of carbonate, nitrate and phosphate that often become part of the conventional hydrochemistry analysis and with stoichiometric importance. However, often related to human interference in the hydrological cycles and negative bioactivities.

9.1.1. Chloride (Cl^-)

The mean concentration of chloride in granitic rocks is 250 ppm in basalts 172 ppm, 32 ppm in shale. In the waters of oceans is 19400 mg/l, 6.8 mg/l for rivers and groundwater 59.7 mg/l (Shvartserv, 2008). Is the predominant form of naturally occurring chlorine element, being present in all types of natural waters, primarily as anion, and despite relative stability chemistry, its salts are highly soluble. Their concentrations are quite variable, increasing as the proximity or genetic relationship with the seas, pickles, evaporite rocks and also greater depths of aquifers (Hem, 1989; Tölgyessy, 1993).

Its compounds in natural aqueous solutions are usually associated with the main cations and due to its predominance in the waters near the sulfate and bicarbonate, receives specific names of water with chlorine-in accordance with all policies consulted for classification of mineral waters (White, 2013).

The various bioactivity and therapeutic indications of chloride and its salts main, contained in saline water or high mineralization, are described in item BAC total dissolved salts (STD and isotonic hipertônicos), since this is usually its main anion.

Mineral waters of middle residue most samples of this work, the associated cation most commonly evaluated is sodium. In this way, the value of minimal bioactivity adopted potentially medicinal (MCl) is based in water considered curative and classified as clorossódica of Hygeea Source, in Băile Herculane, Caraş-Severin County (Romania) with 607 content mg/l Cl-393 mg/l Na +. Its applications have recognized effects diuretics and hepato-biliary ducts cleaning (Dumitrascu, 2011).

For medium mineral water with levels above 1000 mg/l of Cl- and also classified as sodium chloride were found work mainly focusing on benefits and treatments for digestive system (Zakomernyĭ et al., 1985; Chaban et al., 1990).

The research on the source of Mirgorod health resort (Ukraine) with 1400 mg/l Cl-, which is widely used for postsurgical recoveries (Ulianova et al., 1971; Zhuk and Andreev, 1975; Kuchma et al., 1983; Sapa and Revutskiĭ, 1996; Babov et al., 1999; Razumov et al., 2009).

The minimum value for their bioactivity in baths (BCl) is based on the evaluation of the characteristics balneológico with interest in natural resources of Iraq, where hydromineral fountains possessing levels above 1171 mg/l Cl-are considered as potential for the installation of ventures in the SPA (Al Dulaymie et al., 2011). The choice of this value is enhanced by the similarity to the Cuban policy, which ranks as those chloride mineral waters with more than 1200 mg/l Cl- (Fagundo et al., 2001).

In balneotherapy are considered exciting action and Resolutive of exudados by termalidade and stimulating blood and lymphatic circulation cell by mineralization. The higher its concentration, more intense effects that are used in gynecological disorders in nas crenotherapy sequelae of inflammatory processes and menstrual changes.

In rheumatology, saline thermal baths are recommended and they (sea). In respiratory diseases, especially chronic inflammatory processes, your inhalation accompanied by the baths is bronchodilator (Frangipani et al., 1995).

Controlled clinical trials with external applications, such as cosmetics involving mineral waters containing sodium chloride and potassium showed that, after two weeks of applications, effectiveness for atopic dermatitis and chronic treatments (Yoshizawa et al., 2003).

The main biological effect in therapeutic uses threads (or external) chloride (sodium) contained in the hot springs or minerals is hydration keratin layer in hiperqueratocit disorders (Nunes and Tamura, 2012). In dermatological balneotherapy acts as antiflogistic, resolutive in torpid processes (or inactivity) and with indication for various rashes (especially the vulvar) when in waters containing sulphate, calcium and magnesium also, these can be indicated in eczema and psoriasis (Laguarda, 2002).

The recommendation of minimum consumption for adults is 750 mg/day of Cl- (Freeland-Graves and Trotter, 2003). The typical average consumption is 5670 mg/day and maximum 13000 mg/l Cl-. The recommended Guide content in drinking water is 250 mg/l of Cl-and the value typically found in human's daily consumption of 20 mg/l of Cl-, corresponding to 1% and 9% of the total chloride consumed in the human diet as an adult (WHO, 1996).

The recommended value as maximum of chloride in drinking water, where sensory losses occur to the palate, it is 310 mg/l Cl-(IOM, 2004), being this the content here selected as threshold for potential bioactivity in diet (DCl). As its minimum value, the level of 60 mg/l Cl- is selected because it is the same as the Source of hidromineral Morshynska in Prykarpatye (Ukraine), where several studies report their effectiveness in gastroduodenal treatments (Abragamovich et al., 1979; Dzvonkovskiĭ, 1986).

These waters can also be interesting nutritional option to avoid deficiency of sodium in diet integrators restrictive on this element, without causing the same damage to health when of their consumption as food kitchen salt. In this study, the authors used water with chlorine-containing very similar at the same minimum here selected 63.7 mg/l Cl-(Schorr et al., 1996).

The chloride is basic in the digestive process and ferrous salt waters have metabolic bioactivity, anti-inflammatory and anticatarrais. When calcium, increases the permeability of cell membranes (Mourão, 1992). For gastrointestinal pathologies, their intake stimulates bile secretion, tripsínica and cloridropéptica (Frangipani et al., 1995). Can also be recommended for regular or lower levels of sugars in the blood (Moss, 2010).

As well as sodium and potassium, is physiologically essential muscle activities at equilibrium, osmotic in the acid-base balance and distribution of water in organisms. Its deficiency may cause hypotension and metabolic alkalosis (Freeland-Graves and Trotter, 2003; Queneau and Hubert, 2009). Other biological functions were compiled (ANNEX TABLE CRENOTHERAPY INDICATIONS).

Database query published as "Clinical Trial, Journal Article and Review" with the words "mineral water" considered AND "chloride" on database http://www.ncbi.nlm.nih.gov/pubmed indicated 113 results.

9.1.2. Bicarbonate (HCO_3^-)

The average concentration of bicarbonate in the waters of oceans is 488 mg/l, from 55.2 mg/l for rivers and groundwater 187 mg/l (Shvartserv, 2008). Its origin in the waters is related to dissolution of aluminosilicates whether mineral and carbonated (limestones and dolostones), boosted by the presence of dissolved carbon dioxide in almost all types of natural waters with pH < 8.3 (Eh, 1989).

The three forms of carbon electrolyte are changed, mainly according to the pH, being: at pH < 4.5, there is the absolute predominance of CO2 in pH of 8.3 to the HCO3-and at pH > 10.5 of CO3-2. The terrestrial environmental conditions favour the predominance of form bicarbonate and common precipitation of CaCO3. It is also the most common source of alkalinity, as ability to tamponade or neutralisation of acidity (Tölgyessy, 1993; White, 2013).

Its compounds in natural aqueous solutions are usually associated with the major cations (Brezonik and Arnold, 2011) and due to its predominance in the waters near the chloride and sulfate, receives specific names bicarbonate water, according to all the directives have been consulted for the classification of mineral waters contains the minimum of 1000 mg/l HCO3- in Russia and Ukraine, 1200 mg/l HCO3- in Cuba and 600 mg/l HCO3-in Europe (Fagundo et al., 2001).

Pre-clinical trials with the alkaline bicarbonate water of health Source of Uliveto (Italy) indicated an improvement in the functions and gastric dyspepsia (Bertoni et al., 2002). Other pharmacological study in guinea pigs by ingesting for 30 days this water was compared to intake of other low mineral water, having been demonstrated their efficiency in the improvement of diarrhea, constipation and colitis (Fornai et al., 2008). In a similar experiment, the same water assisted in oxidative stress protection and treatment of hemorrhagic gastric lesions caused by alcohol consumption (Nassini et al., 2010).

In this way, the content of the bicarbonate water of Uliveto (Italy) with 683.2 mg/l HCO3-, is adopted in this work as a reference for potential therapeutic biological activity (MHCO3). The choice of this value is enhanced by the similarity to European policy, which ranks as mineral waters bicarbonated those with more than 600 mg/l HCO3-(Fagundo et al., 2001).

Short-term clinical trial with spring water alkaline bicarbonate health New Zealand, ingested during 84 days, by a group of 67 women in post-menopausal stage, provided positive results for the acid-base balance of the body, bone metabolism and related cardiovascular risk factors. This content was of 650 mg/l HCO_3^-(Day et al., 2010).

Biological activity functional investigated in mediomineral sodium bicarbonate water (690 mg/l HCO_3^-) Pitoniakówka source in Szczawnica (Poland), through their intake during 24 days for guinea pigs, meant an inhibition of the motor activity of small intestine, increased urination and increased volume of water in their bodies (Drobnick and Latour, 2001).

The intake of calcium and other ions as well as an alkalizing diet less acidic, has proven benefits for bone health. For such an assessment if they use the index of acidity potential renal load of a food (PRAL "potential renal acid load") which can be calculated in mineral waters through its contents in SO_4^{-2}, P, Cl^-, HCO_3^-, Na^+, K^+, Mg^{+2} and Ca^{+2}. Indexes PRAL >0 are considered acidifying unfavorably and PRAL 0 capable of alkalizing <greater retention of calcium excretion. In statistical analysis with 150 bottled mineral waters of Europe and 40 of the United States, found that on average of 713 mg/l HCO_3^-, these waters have to <and therefore can 0 be beneficial to bone health (Wynn et al., 2009).

Through topical applications in hypotonic water rats, calcium bicarbonate-magnesian from Comano (Italy), can be seen anti-inflammatory activity and power of regeneration in skins with dermatoses (Faga et al., 2012). So, your levels of 196.6 mg/l $HCO_3^-$is considered here as a minimum for potential bioactivity balneoterápica or external use (BHCO3). Such a decision is also based on the similarity of this value with the evaluation of the characteristics balneológico with interest in natural resources of Iraq, where hydromineral fountains possessing above levels of 136.6 mg/l $HCO_3^-$are considered as potential for the installation of ventures in the SPA (Al Dulaymie et al., 2011).

The applications in these waters in skin disease treatments are indicated in various spas of Spain (Laguarda, 2002). With sedative effects in baths, also contribute to the natural hydration of the skin, combating excessive oiliness and Seborrhea (Frangipani et al., 1995). Cosmetic waters with bicarbonate helps prevent the formation of free radicals, inducing changes in enzyme activities (Nunes and Tamura, 2012).

Systematic clinical study in groups of elderly people with osteoarthritis in the hands, who for three weeks have made daily immersion baths for 20 minutes in the water, bicarbonate SPA Gunaras (Hungary) with 1403 mg/l HCO3-, demonstrated clinical improvement pathological, reduction of pain and improvement in quality of life (Horváth et al., 2011). The similar levels of 1300 mg/l HCO3-is the minimum required for waters of interest in SPA baths, according to quality criteria suggested by the European SPA Association (ESPA, 2006).

As a minimum value for potential nutritional bioactivity of bicarbonate (DHCO3), the equivalence adopted will be again the epidemiological study of Ust-Ilim region (Russia), that substantiate the BAC STD medium mineralization (DMEIO) due to the scope of this work, as well as the special focus directed to this anion when dissolved in water with at least 243.7 mg/l HCO3-(Fight, 1992).

In this magnitude also exemplifies evaluation to prove the antioxidant effects obtained in spa goers bicarbonated waters of sulfated Jaraba-Sicilia in Zaragoza (Spain) with 301.3 mg/l HCO3-(Hernandez-Torres et al., 2004).

Observation of 22 patients with kidney stones demonstrated that the consumption of water containing from 100 mg/l Ca + 2 and 305 mg/l HCO3-, can assist in litogênica excretion and decrease the chances of their formation (Caudarella et al., 1996). The same occurring with the spring water Cerelia (Italy) containing 119.7 mg/l Ca and 412 mg/l HCO3-; where are notorious effects diuretics (Bertaccini and Borghesi, 2009).

In a systematic review of literature on epidemiological effects related to the consumption of drinking water is public suggested that a 403 content mg/l HCO3-can bring benefits related to heart and bone health risks (Rylander, 2008). The mineromedicinal water sodium bicarbonate-calcium source Bains-les-Bains (France) with 409 mg/l HCO3-is recommended in cases of chronic arterial circulatory problems of the extremities, rheumatology and traumatic sequelae (Lacroix and Aboyans, 2005).

The ingestion of water with levels above 600 mg/l HCO3-assists the acid-basic balance of digestion and the blood, increases its concentration in body fluids, and can relieve States of fatigue and hangovers (Mayer et al., 1992).

There are many jobs where bicarbonated waters are researched and with demonstrated efficacy for all aspects of health cited, most with levels above 1000 until 3388 mg/l HCO3- (Siener et al., 2004; Schoppen et al., 2004; Wynn et al., 2009;

Toxqui et al., 2012). Levels of this magnitude are also found in various brands of bottled mineral waters in Europe, considered rich in bicarbonate (Qeneau and Hubert, 2009). However, in Brazil these values are not legally permitted and, either, its instances naturally observed.

Bicarbonated waters tend to be classified and evaluated according to the accompanying cations, as well as by anions when proportionally associates. Chemical, biochemical activities, of taste and therapies can be much influenced. The bioavailability of Ca + 2, Mg + 2 and other electrolytes may be increased in the presence of bicarbonate (Feillet-Coudray et al., 2003) and health issues when associated with sodium chloride, appear to occur when the bicarbonate. These waters, termed as alkaline bicarbonate, can be indicated in fighting obesity and hypertension, as noted in a study with a sample containing 878 mg/l HCO3-and Na + 153.2 (Meijide et al., 2006).

Bicarbonated with sodium or alkaline waters are given in aid of digestion, secretion deficiency and treatment of diseases of the digestive system, such as: intestinal hypermotility, duodenal ulcers, diarrhea, liver and kidney (Mourão, 1992; Frangipani et al., 1995). The bicarbonated, calcium magnesianas or mixed are indicated in the improvement of digestion, problems related to nutritional disorders: gout, uric acid lithiasis, obesity, diabetes, rheumatism and dermatitis. The bicarbonated sulphated in detox, liver disorders and for thinning regimes. And the chloride in rheumatic treatments bicarbonated (Mourão, 1992; Petraccia et al., 2006; Roques et al., 2009).

Other biological functions were compiled (ANNEX TABLE CRENOTHERAPY INDICATIONS). Database query published as "Clinical Trial, Journal Article and Review" with the words "mineral water" considered AND "bicarbonate" or "hydrogen carbonate" http://www.ncbi.nlm.nih.gov/pubmed database provided 74 results.

9.1.3. Sulfate (SO_4^{2-})

The average concentration of sulphur in igneous rocks is 260 ppm in schists and limestones of 1200 ppm 2400 ppm) in soils and natural waters, their main form of occurrence is as anions sulphate (SO42-). The average concentration of 700 ppm in the soil is mainly related to humic volcanic processes, and proximity to rocks with gypsum, epsomita and barytes, or rich in sulfur, especially iron sulfide. Particles of soil components like iron hydroxide and aluminum oxide possess great power of sulfur adsorption and may raise their concentrations due to human activities in up to 1600 ppm as in the United States (Tölgyessy, 1993).

Being quite soluble and through ionic bonds to soluble salts of Na+, K+, Ca2+ and Mg2+, is one of the main sulfate anions present in waters, with average content in the oceans of 2712 mg/l, in the rains of 2.4 mg/l, in shallow rivers and Lakes of 9.7 mg/l and in aquifers with 70.7 mg/l. The largest concentrations can be found in natural brine and seleníferas waters (Shvartserv, 2008).

Over 30% of the sulphate present in groundwater comes from atmospheric processes, the remainder of geological and biological processes. Despite the relative stability in aqueous solutions natural chemistry, where normally the sulfides are slowly bleached in sulfates, in anaerobic environments the biochemical processes tend to reduce it to hydrogen sulfide, a gas well with high solubility (Hem, 1989).

Receives specific names of sulfated water, according to the directives consulted for classification of mineral waters with levels above 1000 mg/l SO42- in Russia and Ukraine, with 950 mg/l SO42- in Cuba and 200 mg/l SO42- in Europe (Fagundo et al., 2001).

The various bioactivity and therapeutic indications and sulfate salts main, contained in saline water or high mineralization, are described in item BAC total dissolved salts (STD-hypertonic and isotonic drinks), since this is typically one of their main anions. Are called mineromedicinal waters sulphated those where this bioactivity, anion has main features: inhibition of gastric secretion, increased bowel activity and gastric and pancreatic secretions offset to the intestines (Vasylivna, 2008).

Recent studies show that the bioavailability of calcium sulphate mineral waters, like Ca2SO4, is equivalent to that of milk and no interference in the urinary excretion of calcium, only slight increase in fecal flow as secondary effect. In a randomized controlled trial to 180 women (older) and postmenopausal with low daily consumption of calcium; after six months consuming water sulfated cyanamide, demonstrated beneficial effects on bone resorption of calcium (Constant and Hawili, 2011).

Being mineral water Vittel (France) with 328.9 mg/l SO42-, one of the used in this and in other studies (Toussaint et al., 1988; Couzy et al., 1995; Heaney, 2006), leading to selection of this value as the minimum of potential therapeutic biological activity (MSO4).

Other works cite benefits of sulfated waters with higher levels being for patients with Ileostomy, where their consumption promotes a higher magnesium and calcium absorption in the small intestine from 739.2 mg/l SO42- (Normén et al., 2006) or as water intake of Capvern Les Bains (France) with 984 mg/l SO42-; demonstrating thus indications for removal of cholesterol and combating obesity (Toussaint et al., 1988; Hanh et al., 2012).

The levels above 2800 mg/l SO42-promote spontaneous circadian variation in the significant size of the gallbladder (Gutenbrunner et al., 2001), while in waters with 1600 mg/l SO42- pharmacological trials a year with guinea pigs showed auxiliary power in chronic diseases, ulcers and digestive cancer colo-rectal, through reducing sulphate beneficial changes in intestinal bacterial flora (Deplancke et al., 2003).

In another study, postmenopausal women age 40 and with problems of functional dyspepsia consumed during one year, at least two daily doses of water sulfated comes from Source Chinciano (Italy) with 1840 mg/l SO42- getting litogênicos effects besides the positive normalization of intestinal flow and maintenance of body weight regardless of the Diet adopted. Such factors of fundamental importance in reducing the risks of atherosclerosis and cholesterol-related diseases ("gallstone") (Corradini et al., 2012).

The minimum content for bioactivity of the electrolyte sulfate, through external applications (BSO4) is based on the evaluation of the characteristics balneológico with interest in natural resources of Iraq, where hydromineral fountains possessing above levels of 408 mg/l SO42-, are considered as potential for the installation of ventures in the SPA (Al Dulaymie et al., 2011).

Sulphated water baths have sedative properties in immersions with temperatures between 43 and 46°C, being recommended for joint treatments (rheumatology) (Frangipani et al., 1995), as well as for bruises, cuts, burns, high blood pressure, hardening of the arteries and external wounds (Serbulea and Payyappallimana, 2012). In dermatology, are effective in treating eczema and psoriases (Laguarda, 2002), improved local irrigation (Bundschuh et al., 2007), with antibacterial and antifungal, anti-inflammatory actions (Nunes and Tamura, 2012).

Your intake is also recommended in dermatological pathologies by digestive and metabolic benefits as: activation of oxidations, glicogenic and functions in the acid/base balance. In gastrointestinal diseases crenotherapy stimulate peristalsis with laxative properties, colagogas and coleréticas (Frangipani et al., 1995).

As the predominant cation, if usually differentiate the indications in calcium (rheumatism, bruises, cuts and Burns), sodium (high blood pressure, strengthening of the arteries and in external wounds) and magnesianas (idem to previous two) (Michelan, 2000). Other biological functions were compiled (ANNEX TABLE CRENOTHERAPY INDICATIONS).

Statistical analysis with 150 bottled mineral waters of Europe (average 260 mg/l SO42-) and 40 of the United States (average 131 mg/l SO42-), selected by calcium levels above 100 mg/l; indicated that the main anions SO42- and HCO3-, are not found together in high amounts in the same water, regardless of their total mineralization (STD). There is also a strong correlation between sulphate and calcium to waters with low content of bicarbonate. Geochemical differences between these anions may explain this finding and its mixture due to meteoric processes is inferred to sole source hidromineral rich in both (Wynn et al., 2009).

The typical average consumption of sulfate for adults is estimated at 4400 mg/day, while the average in over 1600 public drinking water of the United States be of 24 mg/l SO42-, often being its largest nutritional contribution (EPA, 2003). The concentration of 600 mg/l SO42-is the ceiling for the risk of the occurrence of diarrhea and also undesirable effects on your palate. And this will be here adopted as higher value of potential biological activity dietetics (DSO4).

For this type of BAC, the minimum sulfate follows work with the observation of antioxidant effects in spa goers bicarbonated waters of sulfated Jaraba-Sicilia in Zaragoza (Spain) with 158.4 mg/l SO42- (Hernandez-Torres et al., 2004).

Database query published as "Clinical Trial, Journal Article and Review" with the words "mineral water" considered AND "sulfate" or "sulphate" http://www.ncbi.nlm.nih.gov/pubmed database provided 93 results.

9.2. Main Cations

Ions are positive charges common in almost all natural waters and predominant concentrations to other dissolved anions, which are among mg/l and g/l. in this work, the following are approached sodium Na+, Ca2+, calcium magnesium

Mg^{2+} and potassium K^+. Although the latter with evident relative to the other supplemented.

9.2.1. Sodium (Na^+)

The average concentration of sodium in igneous rocks is 400 ppm, limestones in 23600 in schists and in soils 6300 ppm 9600 ppm, being the most reactive cation, especially in alkaline soils. In the waters of oceans 10800 mg/l, 5.9 mg/l for rivers and groundwater 67.6 mg/l. its main source minerals are feldspars plagioclase overgrowths, little resistant to intempéricos processes, mainly chemists and its salts formed are very soluble (Tölgyessy, 1993; Shvartserv, 2008).

Environmental dynamics is usually similar to that of potassium and the main form of occurrence of this element is as simple cation waters and in the waters of strong mineralization is associated with the main anions, especially chloride (White, 2013).

The biochemical behavior can be well defined in 4 physiological interest groups, according to the concentrations of STD in the waters: hypertonic, isotonic, hipotonic and light mineralization. Because the vast majority of hydromineral fountains have low mineralisation, Brazilian will be here recorded the potential therapeutic bioactivity (MNa) and balneotherapy (BNa) associated with the group of hipotonic waters (STD <8000 mg/l) and how nutritional BAC (DNa) the group of light mineralization (STD <1000 mg/l).

In this way, the value of minimal bioactivity adopted potentially medicinal (Nam) is based in water considered curative and classified as clorossódica of Hygeea source, in Băile Herculane, Caraş-Severin County (Romania) with 393 content mg/l Na^+ and 607 mg/l Cl^-. Its applications have recognized effects diuretics and hepatobiliares ducts cleaning (Dumitrascu, 2011).

With larger values (599.8 mg/l Na^+ and 2016 mg/l HCO_3^-), bicarbonated with sodium mineral waters were systematically ingested by hypertensive and not 10 people 10 hypertensive during 4 consecutive days. The results showed an increase in calcium excretion and decreased blood pressure, indicating its possible benefits to hypertensive (Luft et al., 1990).

For water with levels above 1000 mg/l Na^+ and associated with the main anions (HCO_3^-, Cl^- and SO_4^{2-}), sometimes even more than one simultaneously, were found as many published works, titling them as rich in these elements, and consumed internally during clinical trials. The main approaches of efficacies, cited: chronic kidney stones, colicistitis, disquinesia, biliary liver pathologies in children, lithiasis, gastritis, ulcers, cardiovascular problems and peptide lipaemia in postmenopausal women (Ulianova et al., 1971; Zhuk and Andreev, 1975; Kuchma et al., 1983; Sapa and Revutskiĭ, 1996; Schorr et al., 1996; Babov et al., 1999; Schoppen et al., 2004; Razumov et al., 2009).

The minimum value for their bioactivity in baths (BNa) is based on the value considered optimum for water from SPA, according to the concentration suggested by definitions of United States SPA guides; being of 725 mg/l Na + (Lund, 2000), also very close to the policy for the traditional practices of Japan's onsen balneotherapy 600 mg/l (Serbulea and Payyappallimana, 2012).

The main biological effect on therapeutic uses of sodium topics contained in thermal or mineral waters is in cell renewal (Nunes and Tamura, 2012). Balneotherapy in dermatology, operates in the electrolytic cell balance intervention when the waters of high mineralization (compounds in chlorides and sulfates) and moisturizing action on low STD (Laguarda, 2002).

The recommendation of minimum consumption for adults is estimated between 500 and 2000 mg/day of Na+ (Freeland-Graves and Trotter, 2003), although in Yanomami indigenous communities (Brazil) no health problems are followed by 200 mg/day intake of Na+. The average world consumption typically observed by adults is 3510 mg/day of Na+ (IOM, 2004). Under evaluation in British Columbia (Canada), was detected in 6% sodium deficiency, a sampling of 2000 people, this being the lowest percentage among the constituent 12 mineral nutrients assessed (Campbell, 2001).

In fact, the excess consumption has become increasingly a dietary problem worldwide. In Brazil, possessing food above 200 mg/kg of Na+ must quote in the package "contains sodium" (BRAZIL, 2000) and in accordance with European legislation, classified as mineral waters with sodium are those with more than 200 mg/l Na+ (I, 2009). In the same policy of this continent, are considered convenient water in dietary regimes, those with contents of less than 20 mg/l of Na+.

The concentration considered typical of sodium contained in drinking water is 20 mg/l, the maximum of 220 mg/l and a standard reference ("guidelines") of 200 mg/l Na+, being that these values correspond, respectively, to 1%, 13% and 11% of the total human diet of this element (WHO, 1996). Systematic physicochemical analyses of public drinking water, consumed in 144 different cities of the United States, showed an average of 38 mg/l and a maximum of 391 mg/l Na+ (Pehrsson et al., 2008).

Evaluation of two weeks in groups of people consuming with mineral waters similar levels of bicarbonate and calcium, but different as to sodium indicated that the lowest content of this element has increased phosphate excretion without altering the calcium, but may be useful in the prevention and treatment of osteoporosis (Vezzoli et al., 2010).

The water in question comes from Source Sangemini (Italy) with 21 mg/l Na+ and 975 mg/l STD, this being the maximum value selected from potential biological activity dietetics (DNa). For such a choice, are also considered recommendations on similar limit due to change in the taste of drinking water, interest in slimming regimes or low in calories (IOM, 2004) and infant feeding (Rudzka-Kantoch and Weker, 2000).

Sodium has an important role in the exchange of salts, stimulates the functions of the bile duct and gall-bladder cells, influences the Hepatobiliary system and digestive glands secreting activities and intensifies the process laxative (Vasylivna, 2008). Stimulates and purifies the lymphatic system and is indicated in Hydrotherapies for arthritic treatments (Moss, 2010).

As well as the chloride and potassium, is physiologically essential muscle activities at equilibrium, osmotic in the acid-base balance and distribution of water in organisms. Despite his excessive consumption be associated negatively since the Decade of 1960, especially at hypertension, obesity and heart risks (Mcgregor et al., 1989), its deficiency can cause hyponatremia, nausea, anorexia, weakness, convulsions and mental confusion (Freeland-Graves and Trotter, 2003; Queneau and Hubert, 2009).

Database query published as "Clinical Trial, Journal Article and Review" with the words "mineral water key considered" AND "sodium" in the database provided http://www.ncbi.nlm.nih.gov/pubmed 211 results.

9.2.2. Calcium (Ca^{2+})

The average concentration of calcium in igneous rocks are calcareous 302000, 41400 ppm ppm ppm 22100 schists, and soils between 7000 and 500000 ppm. In the waters of oceans is 411 mg/l, rivers is 14.7 mg/l and in groundwater is 39.2 mg/l. The main sources of calcium are the plagioclase overgrowths, calcite, dolomite, and apatite. It originates in groundwater by reactions of calcium bicarbonate and its solubility is the basis of the quantity of dissolved carbon dioxide (CO2). The amount of this gas depends on temperature and pressure, which therefore will influence their typically low to moderate solubility in pure water (Shvartserv, 2008).

Selenium-rich waters tend to have high concentrations of calcium, with sodium this inverse correlation, to the point of sodium predominance. The main chemical and biological activities assigned to hard waters are related more to the magnesium to calcium, though both are essential for health. The waters with flavors most appreciated contains calcium and bicarbonates (White, 2013).

Calcium and magnesium are usually the main present bivalent cations on the water and almost always are in the ionic form simple, but may also occur in more complex Ionic associations, often with similar species of these two elements. Calcium is generally found in higher concentrations that magnesium (approximately 3:1), which may reverse proportion in salt water and some higher mineralization, due to greater solubility of its similar compounds that occur in these environments (Hem, 1989).

For example, carbonates, fluoride and calcium phosphates are six times less soluble than the magnesium carbonate, calcium hydroxide solubility has more than ten times its similar magnesium hydroxide. Thus, the fractions between Ca2+ and Mg2+ may indicate marine influence, rock types and climatic aridity incasing about his compositions hidroquímicas. Also correlations between Mg/Ca and Na/Ca help in the knowledge of its origins, and silicatic rocks, limestone or dolostone (Tölgyessy, 1993).

Experimental studies have shown that prophylactic treatment, through the administration of mineral water Cerelia source (Italy), has biological activity able to induce a significant reduction of the levels of uric acid, also increasing their excretion, urinary volume and pH. Such dilution prevents kidney litogenic processes and assists in their treatments. Among the components of mineromedicinal water stand out 412 mg/l HCO3- and 119.7 mg/l of Ca2+ (Bertaccini and Borghesi, 2009), this being the selected value as minimum for bioactivity of therapeutic calcium (MCa).

Water intake with 50 to 100 mg/l of Ca^{2+} is important dietary source for lactating women, contributing between 24% to 56% of their minimum daily recommendation (Miñana and Jordá, 1999). Another work suggests similar average content of this element for bone benefits and to prevent the formation of kidney stones in 120 mg/l Ca^{2+} and, in the sample studied, the positive effects presented were accompanied with equivalent presence of 305.2 mg/l HCO_3^- and 211.2 mg/l SO_4^{2-} (Marangella et al., 1996).

Some authors suggest best bioactivity of waters with calcium bicarbonate levels in larger company than the sulfate (Böhmer et al., 2000; Temporelli, 2002; Roux et al., 2004; Heaney, 2006). Others disagree, recommending calcium-rich mineral waters together with the sulphate (600 mg/l SO_4^{2-}) as an option of comparative nutritional supplementation with milk (Meunier et al., 2005).

Study in 20 patients with kidney stone problems, ingested 3 different mineral waters during 20 consecutive days. As a result, if noted greater increase in urinary excretion of calcium in the sample with 123.9 mg/l of Ca^{2+} (235.4 mg/l SO_4^{2-} and 305 mg/l HCO_3^-) which the other highest content in this, 380 mg/l of Ca^{2+} (4 mg/l SO_4^{2-} and 1397 mg/l HCO_3^-). However, for another important type of treatment bioactivity, excretion of citrate, resulting inverse effects (Caudarella et al., 1996). This case illustrates the importance of considering other variables in these types of searches, such as: pH, STD, presence of all elements or even some specific, as well as environmental factors.

Randomized cross controlled trial of just 5 days showed significant increase of the small intestine absorption of calcium and magnesium, when ingested mineral water also composed of 276 mg/l of Ca^{2+}, 55.7 mg/l of Mg^{2+} and 739.2 mg/l SO_4^{2-}, demonstrating their potential benefits in treating Ileostomy (Normén et al., 2006). For several authors, mineral waters are considered rich in calcium, when above 500 mg/l (Böhmer et al., 2000).

But in comparative studies of samples with different concentrations have shown that in content less than 250 mg/l Ca^{2+} occur similar rates of absorption by the body, some seek explanations on bioavailabilities of dilute solutions (Aptel et al., 1999; Guillemant et al. 2000; Galan et al., 2002; Meunier et al., 2005).

In the evaluation of the characteristics balneológico with interest in natural resources in Iraq, hydromineral fountains possessing levels above 256 mg/l Ca^{2+} were regarded as of first installation of potential developments in the SPA (Lund, 2000). This value is then the minimum parameter selected for potential biological activity of calcium in water for baths (BCa).

Through the external uses and balneotherapy of calcic waters some biological activities are found: regulation of growth of epidermal cells and anti-inflammatory action (Nunes and Tamura, 2012), reduced sensitivity in cases of asmas, eczema, skin diseases and bronchitis (Haesbaert, 2009), action on regulatory proteins of divisions and cellular connections (calmodulin, Retinoic acid), a catalyst of protease enzymes, differentiation and transglutaminase phospholipase (essential on permeability of the membranes) (Laguarda, 2002).

In research a year, with more than 1000 participants in elderly Chinese rural community where life expectancy is high and the rate of mental illness below average in that country. 20 samples were collected from water sources where consumption is everyday and analysed large parameters of Cd3+, Ca2+, F-, Fe, Pb2+, Zn2+, and Se2+ pH.

The focus for health risk and prevention consisted of Alzheimer's disease and in the quality of cognitive functions, testing 30 items related to language, memory and attention. The results indicated positive correlations in these health variables with water consumption possessing above 86 mg/l Ca2+, 2.6 mg/l F- e 0.267 mg/l Fe (Emsley et al., 2000).

Again reinforcing the opinion about the importance of assessing the most natural possible variables in these researches, cites the comprehensive epidemiological study using Cohort methodology in Ust-Ilim region (Russia). Where were the rates of morbidity and physical development in 7658 adults, 1582 children and 562 pregnant women with their newborns, inhabitants of 2 communities with similar eating habits, air quality, social conditions and residence time in the respective areas. 15 physical parameters were analyzed chemicals of 2 distinct sources that supply public drinking water for each community.

Before the results highlighting the differences hidroquímicas, statistical data were compared and public health concluded in a big difference for these communities concerning rates of: incidence of goiter, hypertension, ischemic heart disease, gastric and duodenal ulcers, chronic gastritis, colicistite, nephritis, growth and infant mortality, occurrences of edema and anemia among pregnant women. And according to the author, the water considered physiologically great features as key differentiators between 30 and 90 mg/l Ca2+ and with 400 mg/l STD (Fight, 1992).

So this is also adopted as the minimum value for potential nutritional calcium bioactivity (DCa).

Do not been found work on health hazards or limiting recommendations maximum calcium content for everyday consumption.

Research was undertaken into the causes of death of the population of Taiwan, focusing on the dietary influence of drinking water, especially in their levels of calcium and magnesium on blood pressure, cardiovascular risks and the strokes. Average of 34.7 mg/l of Ca2+ (corresponding to 13.7% of total consumption) did not demonstrate protective activities to these problems, and yes, the presence of magnesium (13.5 mg/l, seen below). Maybe the results relate to statistical masking due to high correlation (greater than 0.65) for the presence of these two elements in the samples (Yang, 1998).

The fraction of absorbed calcium mineral waters teeters on average over 35%, being higher than the milk (29%) and pharmaceutical preparations for nutritional calcium supplementation (30%). This fraction seems to have opposite behavior of the abundance of this element. A biological activity quite apparent by supplementation of calcium naturally dissolved in drinking water is the reduction in the level of the hormone hen, demonstrated by several studies. We recommend the consumer choose a mineral water knowing your potential bioavailability and biological activity of your electrolytes (Böhmer et al., 2000; Heaney, 2006; Queneau and Hubert, 2009).

Statistical studies on drinking water United States public and Canada estimate that the average content of calcium nears 50 mg/l, thus contributing with 20% of the total adult diet typical or recommended minimum of 13%. In Europe these average values are slightly higher, that is, 85 mg/l of Ca2 + (IOM, 1980). More recently, systematic physicochemical analyses of public drinking water consumed in 144 different cities of the United States, provided an average of 30 mg/l and a maximum of 100 mg/l of Ca2 + (Pehrsson et al., 2008).

The recommendation of minimum consumption for adults is estimated at 1000 mg/day of Ca2+ (Freeland-Graves and Trotter, 2003). Achieve this minimum has become an increasingly global problem, for example, an assessment in British Columbia (Canada) indicated 46% of disability in a population of 2000 people sampled (Campbell, 2001). And, in spite of the waters they can assist in this problem, due to large bioavailability of dissolved Ca2+ and its natural Ionic balance, just some bottled mineral waters have desirable levels.

There are at least 147 diseases and public health problems that can be attributed to physiological imbalance or deficiency of calcium, the most common being the difficulty of blood clotting, rickets, osteoporosis, arthritis and hypertension (Nielsen, 2000).

Database query published as "Clinical Trial, Journal Article and Review", with the words considered mineral water "AND" key "calcium" http://www.ncbi.nlm.nih.gov/pubmed database resulted in 178 articles.

9.2.3. Magnesium (Mg^{2+})

The average concentration of magnesium in igneous rocks is in 2700 limestones 23300 ppm ppm ppm 15000 schists, and soils is 5000 ppm, and may be higher in basalt, serpentinites and dolostone. And in the waters of oceans is 1290 mg/l, rivers is 3.8 mg/l in groundwater is 18.2 mg/l. The main sources of magnesium are amphibole, piroxen, dolomite, magnesite and clay. It has forms of occurrence similar to calcium, being slightly more soluble and more difficult to precipitate (Hem, 1989; Shvartserv, 2008).

Mineral waters are classified as magnesian are suggested in France as indications in vascular pathologies, as well as rheumatology and Gynecology in external uses. Among them: Dax, Neyrac-les-Bains and Léchère-les-Bains (Lacroix and Aboyans, 2005).

But the minimum value for bioactivity therapy (MMg) selected is the mineral water Vernière (France) with 66 mg/l of Mg2+, by current indications for children, adolescents, pregnant women, lactating women and ladies post menopause (Constant and Hawili, 2011). Also, for similar value found in natural sources of potable water in the region of Zlatibor (Serbia) from 68.8 mg/l of Mg2+ indicate strong correlation at lower average rates for cases of hypertension, heart disease and stroke their 65000 inhabitants (Jovanovic and Brkic, 2012).

Study of mineral waters with different concentrations of magnesium, consumed in groups of 70 people during 4 weeks, demonstrated that the content of 82.3 mg/l of Mg2+ enables a decrease in blood pressure of its consumers (Rylander, 2008). Some authors consider how water rich in magnesium, in this range of values (80 mgl/l) (Galan et al., 2002; Verhas et al., 2002; Nórmen et al., 2006). Others evaluate therapeutic benefits or even water with epidemiological levels above 100 mg/l of Mg2+ (Thomas et al., 2000; Sabatier et al., 2002; Kiss et al., 2004; Karagülle et al., 2006; Day et al., 2010).

Some evidence suggests that the absorption and bioavailability of magnesium behave inversely proportional to its value ingested; both in food (Sabatier et al., 2011) as dissolved in mineral waters (Nakamura et al., 2012). It is also interesting to mention the relative indifference in their bioactivity, anionic Association comparative of Cl-, HCO3- or SO42- (Feillet-Coudray et al., 2003).

The minimum value for their bioactivity in baths (BMg) is based on the value considered optimum for water from SPA, according to the concentration suggested by definitions of United States SPA guides, being of 121.6 mg/l of Mg2 + (Lund, 2000). He is close to the policy for SPA of Europe of 150 mg/l (ESPA, 2006).

The main biological effect in therapeutic uses magnesium topics contained in thermal or mineral waters is in the recovery of acute dermatitis, cell renewal, reduction of excessive cell proliferation and inhibition of the synthesis of some polyamines in psoriasis, anticarcinogenic and vasodilation effect with decreased blood pressure (Nunes and Tamura, 2012).

Magnesian waters in external uses benefit the skin, and may catalyze the synthesis of nucleic acids, proteins and ATP, but cause sedation in the central nervous system (Laguarda, 2002).

The epidemiological study of Taiwan on morbidity due to vascular problems demontrou protective dietary influence of water with the minimum of 13.5 mg/l of Mg2 + (Yang, 1998).

Similar research in 27 cities in Sweden have shown decreased mortality due to cardiovascular problems with minimum values of 15 mg/l of Mg2 +, in the drinking water of those communities (Marx and Neutra, 1997).

Another study involving 3 types of drinking water provided to communities in the region of Ust-Ilim (Russia), indicated physiological advantages concerning sourced containing 17 mg/l of Mg2+; with varying benefits to public health as: goiter incidence rates, hypertension, ischemic heart disease, gastric and duodenal ulcers, chronic gastritis, cholecystitis, nephritis, growth rate and infant mortality, occurrences of edema and anemia among pregnant women (Fight, 1992).

Based on these three examples, was chosen as the minimum content for organic nutritional potentiality (DMg) of magnesium 13.5 mg/l of Mg2+, being its maximum value of 250 mg/l of Mg2+, due to induction of bitter taste in drinking water (Tölgyessy, 1993).

In the Decade of 1970, statistics about the United States public drinking water, Canada and Europe showed an average of 6.25 mg/l and a maximum of 120 mg/l of Mg2+, corresponding this typical consumption corresponding to maximum 7% of the minimum recommendation of your total daily intake per adult (IOM, 1980).

More recently, systematic physicochemical analyses of public drinking water, consumed in 144 different cities of the United States indicated an average 9 mg/l and a maximum of 46 mg/l of Mg2+ (Pehrsson et al., 2008).

The recommendation of minimum consumption for adults is estimated to be 310 µg/day of Mg2+ (Freeland-Graves and Trotter, 2003) and this value is very close to the average consumption tpicamente observed by adults.

Breast milk has approximately 40 mg/l of Mg2 + (WHO, 1996). Due to large bioavailability of Mg2 + dissolved in natural Ionic balance and, when dissolved in water, its potability is often useful in contributing to shortcomings and particularly in periods of gestation and lactation (Tubek, 2007).

Under evaluation in British Columbia (Canada) was established in 49% deficiency in a sampling of 2000 people; being the largest magnesium problem among all mineral nutrients assessed (Campbell, 2001). But this problem can be considered international concern and with a tendency to evolve, according to the trend of modern lifestyle (Queneau and Hubert, 2009).

Magnesium is essential in more than 350 enzymatic reactions. Your grace period increases the risk of cardiovascular diseases, immunological, gestation, infant nutrition and stroke (Nielsen, 2000; Freeland-Graves and Trotter, 2003).

Database query published as "Clinical Trial, Journal Article and Review" with the words "mineral water" considered AND "magnesium" http://www.ncbi.nlm.nih.gov/pubmed database provided 98 results.

9.2.4. Potassium (K^+)

The average concentration of potassium in granitic rocks are calcareous in 2369 157100 ppm ppm and in shale is 52367 ppm. In the waters of oceans is 392 mg/l, 0.1 mg/l rainfall, rivers 1.8 mg/l and in groundwater 5.15 mg/l; the higher the depth of percolation in the aquifer, the greater its content dissolved in waters, also contributing to its enrichment contact with potassium feldspar, shales, evaporites, with some natural brine and can reach 100000 mg/l K+ (Hem, 1989; Shvartserv, 2008).

Has high solubility and is difficult to precipitate. In freshwater, usually under the ionic form, but when the total residue (STD) are larger, as in salty waters, can be like salt, sulfate or chloride associated with bicarbonate. The relationship of electrolyte concentration with sodium is usually 15Na: 1 k, but atmospheric waters this proportion may decrease to 2from: 1 k. Higher levels of dissolved potassium can increase the level of radioactivity of the waters, due to presence radionuclide 40 k (Tölgyessy, 1993).

Some mineral waters of Switzerland, bicarbonate and calcium-rich, have been tested in clinical trials of regular consumption in the short and medium term, with the main focus on bone health. The results were positive, by decreasing renal calcium excretion and bone resorption, showing particular interest in the prevention and treatment of osteoporosis (Burckhardt, 2004). Not been obtained numerical values relating to this work, in order to substantiate the value of minimum potential bioactivity therapy for waters with potassium (MK).

Thus, through the compilation of hidroquímicas analysis of the main sources which has become of this country, have chosen the higher level, the source Walderhut, in the region of Baden with 70.3 mg/l K+ and 508 mg/l HCO3- (Vuataz, 1983; Sonney and Vuataz, 2008).

The potassium ion transport through human skin should follow the law of Fick's diffusion, with increasing absorption according to electrolyte largest concentrations. However, some research shows that skin penetration of elements in ionic equilibrium in natural mineral waters is more efficient than in simple solutions, being such anomaly has not yet explained. In "in vitro" experiment with rabbits, were obtained satisfactory results of dermal permeation coefficients for Na+, Li+, Ca2+, Mg2+, and K+ through the topical application of mineral water containing approximately 45.2 mg/l K+ (You et al., 1990).

The evaluation of the characteristics balneológico with interest in natural resources in Iraq, hydromineral fountains possessing above levels of 48 mg/l of potassium are considered as first potential for the installation of ventures in the SPA (Al Dulaymie et al., 2011). While this value close to the work previously cited, is empowered to choose the value of 45.2 mg/l K+ as minimum parameter for potential biological activity in baths (BK). Potassium-containing mineral waters in uses threads have dermatologic interests such as: maintain the muscle tone, vegetative nervous system activity and electrolyte balance cell (Laguarda, 2002).

Systematic physicochemical analyses of public drinking water consumed in 144 different cities of the United States showed average content of 5 mg/l and a maximum of 204 mg/l K+ (Pehrsson et al., 2008). Monitoring of these same types of waters in several provinces of Canada, indicated an average between 1 to 8 mg/l K+, with maximum value of 51 mg/l in this ore-producing region in Saskatchewan (Canada) and at levels of 10 mg/l where these resources are treated with potassium permanganate to reduce its hardness.

In the United Kingdom, the average concentrations are between 2.5 and 5.2 mg/l K+ when they suffer the same kind of treatment. When hardness levels are higher, the limits of health risk of this type of occurrence of potassium also increase their values of acceptance. For example, for hardness of 100, 200 and 500 mg/l CaCO3 are allowed respectively 82; 164 and 411 mg/l K+ dissolved in the same waters (Health Canada, 2008).

Due to the high water solubility of potassium, its absorption is very efficient. There is limited information on the bioavailability of individual foods, because it is better absorbed from food. The average consumption typical of an adult is 2670 mg/day of K+ and its deficiency symptoms can be noted at levels below 2000 mg/day (WHO, 1996).

Potassium has one of the lowest rates of contribution of waters in total diet typical human, i.e. their greatest levels found in most public drinking water untreated from the United States (8.3 mg/l K+) represent less than 1% of the daily average level (IOM, 1980).

The nutritional deficiency of this element can bring essential weakness or muscle paralysis, anorexia, heart arrhythmia, bone weakening and irrational behavior (Freeland-Graves and Trotter, 2003). Some bottled mineral waters have a lot higher levels as: Malvella (Spain) with 50 mg/l, Löwensprudel Obenauer (Germany) with 611 mg/l, Polyana Kupel (Ukraine) with 2000 mg/l and the Fonte San Ciro (Italy) with 205.4 of K+, but with only 1215 mg/l for STD.

To select the minimum amount of bioactivity potassium nutrition (DK), one considers the contribution pattern of drinking water in the typical consumption of minerals that is 5% of the total (Tubek, 2006), being the limit to their disability to 2000 mg/day of K+; i.e. 50 mg/l of K+. For all selections of bioactivity dietetics, the STD value must be less than the limit of 1000 mg/l (Brazil, 2000). For this maximum value, it follows the EPA policy/USA ("Environment Protection Agency") of 100 mg/l of K+ (Mahajan et al., 2006).

Queries the database for standardized clinical trials on potassium nutrient AND water results in 78 studies (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the key words "mineral water" AND "potassium" http://www.ncbi.nlm.nih.gov/pubmed database are obtained 65 results.

CHAPTER 10
TRACE ELEMENTS

10.1. Aluminum (Al^{3+})

The mean concentration of aluminum in igneous rocks is 5000 ppm, in schists and limestones is 82000 ppm is 4200 ppm). In the waters of oceans is 0.001 mg/l, rivers is 0.238 mg/l and in aquifers is 0.226 mg/l in groundwater have values ranging from 0.014 and 0.290 µg/l and the surface between 0.016 and 1.170 mg/l of Al3+; as evaluation in the USA (WHO, 1993; Shvartserv, 2008).

Despite its abundance in the Earth's crust, has little content in natural waters, due its low solubility and ease of retention by clays in intempéricos processes. Higher levels are found in acidic solutions (pH <5), salinas, hot and with spatial movement. They also possess more aluminum from water by coagulation treatments of its salts (Komatina, 2004).

The source of the Health Resort hidromineral Harghita Bai (Romania) is recognized for its therapeutic uses in cardiovascular diseases, digestive system, ophthalmic, hypertension and other chronic inflammations due to metabolic processes of its main components such as aluminum in 0.38 mg/l. therefore, this is the sample selected for the minimum content of (poorly) potential bioactivity of this medicinal element (Babaua et al., 2003).

For the minimum value of aluminum of bioactivity in baths (BAI) using the 3.15 concentration mg/l of Al3+ found in one of the hot springs in the vicinity of the volcano Kusatsu-Shirane Japan where the renowned Onsen SPA Kusatsu comes by applying these classified as acidic water containing sulfur, chloride and aluminium for rheumatic diseases, muscles, skin, cardiovascular and nervous system (Ossaka et al., 1976).

Also notes the content of 31 mg/l of Al3+ in spring water classified as aluminum containing Parádfürdo ferruginous thermal State Hospital in Parád (Hungary), that there are 250 years performs successfully balneotherapy treatments in gynecological and dermatological diseases (Zambó et al., 2008).

The main biological effect in therapeutic uses threads of aluminum contained in thermal springs or minerals is in the recovery of acute dermatitis (Nunes and

Tamura, 2012). In their ionic form, this element interacts with keratin, making it more permeable stratum corneum and facilitating skin penetrations (Smith et al., 1996).

The vast majority of the work found on drinking water containing aluminum is related to toxicological risks associated with neurological disorders, particularly Alzheimer's disease, as well as bone and kidney problems. Despite its reduced bioavailability in this form be of 0.3% (Krewski et al., 2007), the maximum recommended recommendation nutritionally is 0.2 mg/l of Al3+ or the equivalent to less than 10% of the adult diet typical (WHO, 1996). For this reason, the limit value here adopted for their bioactivity in nutrition (DAI) will follow a higher maximum, according to the Switzerland legislation, of 0.5 mg/l of Al3+ (Yokel et al., 2001).

As a minimum content for nutritional bioactivity (DBAI) the value adopted will be 0.125 mg/l of Al3 +, in regard to the pharmacological studies where dietary control demonstrates minimal retention excretora (fecal and urinary) in these intake levels during 20 days (Greger and Baier, 1983).

In the range is the nutritional value of 0.162 mg/day of Al3+, regarded as sufficient for prevention of symptoms attributed to their disability, such as: decrease in growth rate, fertility and life expectancy (Sorenson et al., 1974). In natural tropical environments, where the feeds contains more aluminum, some authors suggest such feature colorful plumage of the largest of these birds in habitats (Komatina, 2004).

For a long time if you know the importance of aluminum in the metabolism of sugars and enzymatic activities (Baudisch, 1943). However, its essentiality has been recently investigated, relating with biochemical actions in activation of the enzyme adenylate cyclase, increased activity of calmodulin, stimulation of DNA synthesis in cell cultures and osteoclast bone trainers, in addition to the short-term prevention by excess fluoride (Nielsen, 2003).

Queries the database for standardized clinical trials on the aluminium results in: 236 studies (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the words "mineral water" considered AND "aluminum" in the specialized database http://www.ncbi.nlm.nih.gov/pubmed provided 30 results.

10.2. Barium (Ba^{2+})

Barium has average concentration in granitic rocks of 816 ppm, ppm de488, basalts in the schists of 270 ppm and 500 ppm solos. Although almost always present, rarely exceeding 1 mg/l in natural waters, being: in the waters of oceans 0.021 mg/l, of 0.045 mg/l rivers and in groundwater 0.018 mg/l. their occurrence tends to be inversely proportional to the sulphate content and, in hot springs artesian basin their contents vary greatly (Tebbutt, 1983; Komatina, 2004; Shvartserv, 2008).

Medicinal applications related to its evident action of increased pressure and heart rate were long ago suggested to some hydromineral fountains containing barium as: Pyrmont (Australia), Kreuznach and Luhatschovitz (Germany), Harrogate and Llangammarch (United Kingdom) (Haycraft, 1923).

Few studies were found relating to natural curative waters, medicinal or therapeutic to the specific content of the element barium. In Poland, made up of 24 health sources evaluation considered its healing SPA where multielements hydrochemistry analyses also revealed levels of barium within therapeutic categories 3: intake (hidropínica) between 0.0036 and 0.073 mg/l, between inhalation and 1.31 0.0036 mg/l and balneotherapy between 0.0036 and 24 mg/l of Ba2+ (Garboś and Swiecicka, 2011).

Another study about therapeutic mineral waters of the region of Saint Petersburg (Russia) where are located various SPA and health resorts, evaluated the result of 170 physicochemical analyses of aquifers, stressing for Barium an average of 0.39 mg/l and the occurrence of values above 1.2 mg/l, which go beyond the recommendation for drinking, but still remaining of therapeutic interest (Voronov and Vinograd, 2009).

As a minimum content of potential biological activity for balneotherapy (BBa) if it adopts the highest value for a potential location for SPA installation used in Iraqi study, corresponding to 0.75 mg/l of Ba2+ (Lund, 2000). This same value (0.75 mg/l of Ba2+) will also be here revealed as the least potentially therapeutic peptide (MBa), but with the maximum limit of 7.3 mg/l due to ignorance on their intake with heart risks and digestive (I, 1999).

In public drinking water, barium is found dissolved with the following concentrations: Netherlands-0.05 mg/l (262 cities), Canada-0.018 mg/l (122 cities), United States-0.043 mg/l and Sweden-0.01 mg/l (Ba2+). Being considered the normal average contribution of water in 20% of the total dietary intake estimated the default value of barium content in 0.3 mg/l (WHO, 2003). This will be the minimum value adopted for their bioactivity dietetics (DBa) and with the maximum of 0.7 mg/l of Ba2+ suggested in the same job.

Queries the database for standardized clinical trials about the barium results in micronutrient studies 58 (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the words "mineral water" considered AND "barium" at www.ncbi.nlm.nih.gov/pubmed database generated 3 results.

10.3. Boron (B^{3-})

Boron has average concentration in igneous rocks 100 ppm, in sandstones 50 ppm and soils 55 ppm. In the waters of oceans has 4.45 mg/l 0.01 mg/l for rivers and groundwater 0.07 mg/l, but in hot springs and juvenile water these levels may be considerably larger (Hem, 1989; Komatina, 2004; Shvartserv, 2008).

The classification of mineral waters as boratadas indicates how content not less than 0.7 mg/l of B3- (or 4 mg/l of H3BO3), provided for by national legislation of Spain and Cuba (Fagundo et al., 2001) and, here also adopted as of bioactivity therapy (MB). Similar levels are described to waters recognised and termed as Russia and Poland's therapeutic, especially indicated for osteoporosis and osteoarthritis (Voronov and Vinograd, 2009; Swiecicka and Garbo, 2009; Drobnik et al., 2010).

For the selection of potential bioactivity of boron in baths (BB) is used as the reference recognized SPA treatments of the thermo-mineral sources of Peninsula Hot Springs (Australia) and Tabacón (Costa Rica) (Erfurt-Cooper and Cooper, 2009), as well as the traditional Japanese legislation based on balneotherapy concepts Onsen, which admits as minimum content considered this element 1.3 mg/l of B3- (Serbulea and Payyappallimana, 2012).

The main biological effect in therapeutic uses boron topics contained in thermal or mineral waters is in cell renewal and healing of wounds (Nunes and Tamura, 2012), but also if they observe changes in cognitive functions and ophthalmologic benefits this type of external application (Benderdour et al., 1998).

The average content of boron in drinking water is 0.02 Germany public mg/l, 0.046 mg/l in China, in Canada and in the United States of 0.15 mg/l. regarding bottled water the average values are 0.36 mg/l in Germany, 0.052 mg/l in China and in the world, with 0.75 wide variation according to the geographical origin (Coughlin, 1998).

Are various epidemiological observations of drinking water containing boron with values in excess of the maximum residue limits established by international rules without submit toxicological effects. There is evidence that in regions where this occurs, are smaller muscle diseases or rates of the skeleton and of cases of cancer among the population.

The current suggested daily intake for human benefit by the World Health Organization is between 1 and 13 mg/day of essential element boron (Korkmaz, 2011).

In several localities where the boron is above of 0.07 mg/l in drinking water, the population rate of arthritis is quite lower than the world average, reaching up to 70% lower. Are known too many SPA with fountains of water, which makes treatments for curing diseases, as is quoted in Nga Wha (New Zealand) containing 0.3 mg/l of B^{3-} (Newnham, 2002).

Study conducted in 15 municipalities of France where the public drinking water contains above 0.3 mg/l of B^{3-} has not demonstrated significant differences in major public health rates in comparison to other locations where these values are smaller. Just found an increase of 17.3% in birth rate (Yazbeck et al. 2005). The same value of 0.3 mg/l of B^{3-} is also the recommended by recent scientific articles to your everyday consumption in drinking water, being the maximum feed of 3 mg/day (Meacham et al., 2010), which are the values selected here (minimum and maximum) as bioactivity dietetics (DB).

The boron as commonly found in water in the form of boric acid is entirely absorbed by the gastrointestinal tract and 99.6% of total ingested is excreted through the urine in 12:0 am. Its distribution occurs through passive diffusion by fluids and their absorption is four times greater and more selective for the bones that in other tissues. Its functions relate to the bone strengthening, increasing muscle mass and brain activity.

Also has influence on the metabolism of other elements and substances such as Ca^{2+}, Mg^{2+}, N^-, O_2, glucose and triglycerides (Nielsen and Meacham, 2011). Acting on endocrine system, balances the level of estrogen and testosterone, possesses antioxidant function and can also assist in antiobesity diets (Freeland-Graves and Trotter, 2003; Usuda et al., 2007).

Queries the database for standardized clinical trials about the micronutrient boron results in 15 studies (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the words "mineral water" considered AND "boron" in the database are listed 12 http://www.ncbi.nlm.nih.gov/pubmed results.

10.4. Bromine (Br^-)

The average concentration of bromine in igneous rocks is 1.9 ppm in schists is 0.49 ppm and soils is 5 ppm. In the waters of oceans is 67300 mg/l, of 0.02 mg/l for rivers and groundwater is 0.103 mg/l (Komatina, 2004; Shvartserv, 2008). Your environmental behavior is similar to that of Cl-, using highly soluble compounds have.

Almost always, the bromine is naturally in low concentrations and in its ionic form in groundwater, that when the United States publicly potable have average content of 0.016 mg/l Br- (Davis et al., 2004).

Several countries are classified as brometadas mineral waters, being common work related to their biochemical relations and health, with emphasis on Russian Institute Voprosy Kurortologii.

Bromine levels tend to be directly related to the total residue (STD) and both directly to marine environments.In order to better define your effective biological potential, are observed 3 distinct types of brometadas: the waters of high salinity and total residue (hipertonic and isotonic) when bromine is often accompanied by the Cl- elements (salso-bromide) and I-(Iodo-brome); the total residue medium, that have use both bottling as for SPA; the minimum residue, where you can watch some highlights of bioactivity of bromine, to the point of use on the highly diluted homeopathic remedies (Homeopathic Pharmacopoeia of the United States and Encyclopedia of Homeopathic Pharmacopoeia-www.hc-sc.gc.ca).

For the first kind of sub-type bioactivity, it is worth noting the Russian legislation (GOST, 1988) which considers those brometadas mineral waters containing above 25 mg/l Br-, which are used primarily in balneotherapy and other external applications. The following are considered sources of therapeutic mineral waters of the region of Saint Petersburg (Russia) where are located various SPA and famous health resorts; hydrogeological survey was conducted with processing of data obtained for 170 physicochemical analyses of 3 types of aquifers, distinguished by their total waste (STD).

As initial content of medical biological activity (MBr), the option is at the source of the health SPA Sestroretsk, balneotherapy centre with its traditional water containing STD of 4200 mg/l and 16 mg/l Br- (Voronov and Vinograd, 2009).

Also describes work of medical protocol, which uses another water of high mineral residue (STD isotonic) and 20 mg/l Br- in external use nasal, with efficacy in chronic inflammatory respiratory diseases. This water salso-bromo-iodinated thermal source of Salsomaggiore (Italy) is also being marketed in pharmaceutical packaging (Fenu et al., 2010).

The third subtype, the example that will serve as a dietary parameter (DBr) refers to large epidemiological study in Norwegian cities 97, which assessed possible correlations of various chemical elements present in the public drinking water with the incidence of 17 groups of diseases. The result of greater evidence was the negative association with the bromine number of occurrences of lung cancer. This effectiveness of bioactivity of bromine is observed at approximately the concentration of 0.05 mg/l Br- in a very diluted solution of total residue (STD) close to 100 mg/l, i.e. in a low mineral water (Flaten and Bolviken, 1991). It is worth mentioning that the lung tissue is more rich in bromine of the human body.

Some physiological actions of bromine are: reduces insomnia displayed by many patients in hemodialysis, sedative at cerebral, alleviates growth retardation caused by hyperthyroidism (animals). Some symptoms are deficiency: decrease in growth rates, fertility, insomnia, life expectancy, quality of the hemoglobin and breast milk; hematocrit, increased miscarriages.

The percentage absorbed in digestion is 75% to 90%. The typical consumption is of 2 to 8 mg/day and in natural concentrations do not know their toxicity (Nielsen, 1998, 2000).

Japanese law Onsen balneotherapy foundations, bromine waters are those classified with 5 mg/l, and this will be adopted here as parameter of bioactivity balnear (BBr). This electrolyte, in external use, has a good capacity of penetration in psoríaticas skins and notorious effectiveness in these types of dermatological treatments (Al Dulaymie et al., 2011).

Although they are mostly considered its toxic effects to establish its content in drinking water limit of 0.025 mg/l (WHO, 2003), bromine is among the 15 ultra traces elements considered with essential biological functions in human diet (Nielsen, 1998).

In this way, to prevent nutritional deficiency, adult consumption of 2 liters of water daily to help with your normal equivalent of 20% of the maximum typical diet of 7.8 mg/day (WHO, 1996) will be of 0.78 mg/l Br-, this being the nutritional content of bioactivity here selected (DBr). (more ANNEX CRENOTHERAPY INDICATIONS indications).

Queries the database for standardized clinical trials about the micronutrient bromide results in only 1 study (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the words "mineral water" considered AND "bromine" specialized database http://www.ncbi.nlm.nih.gov/pubmed raised 14 results.

10.5. Copper (Cu^{2+})

Probably due to its low solubility, copper is element found in low concentrations in all types of natural waters; in lakes or rivers between 0.01 to 0.02 in groundwater between 0.001 to 0.004 and waters of oceans, further diluted, less than 0.0009 mg/l (Baudisch, 1943; Shvartsev, 2008).

In hydrothermal vents are observed his greatest anomalies (18.5 mg/l in Dallol Dome - Ethiopia) as well as a high average levels between 0.05 and 0.25 mg/l (Komatina, 2004). In volcanic environments and assets associated with arsenic-iron sources are most of these occurrences (Albertini et al., 2007).

Have been found in international bibliography only 2 hydromineral fountains directly related to the presence of copper as its main therapeutic feature: Mazowszanka (Poland) with 0.023 mg/l of Cu2+ and 688 mg/l STD (Kot, 2001) and the iron-cuprífera de Saint-Christau (France) with 0.12 mg/l of Cu2+ and 297.7 mg/l STD (Tillot, 1864; www.aquamania.net).

Due to research conducted with antiseptic, anti-allergic and antirreumatic recommendations, particularly for dermatological treatments, are adopted as minimum levels potentially medicinal bioactive (MCu) the values of the source Saint-Christau (France).

In external use or balneotherapy with mineral term waters, the elements copper, manganese and iron divalente have recognized power of cutaneous permeation, and thus, the copper influence the endocrine system, antioxidant metabolism, collagen elastic functions and even treat rheumatic infections (Baudisch, 1943; Laguarda, 2002; Nunes and Tamura, 2012). As minimum value for its effective bioactivity in these types of exhibitions (BCu) is the concentration of 1.3 mg/l of Cu2+ as a reference to Hydromineral fountains in SPA of type "spring" in the USA. This despite citations of interest at levels less than 0.5 mg/l of Cu2+ for selection of areas with potential balneoterápico for installation of SPAs in Iraq, or 0.026 mg/l of Cu2+ rated at Saratoga (United States) (Al Dulaymie et al., 2011).

There is also the absence of ceilings in toxicology topical copper electrolyte. In daily intake, their levels of toxicity, although low, are between 40 to 135 times greater than those recommended for drinking water, 2 to 3 mg/l, but the maximum value or nutritional epidemiological for this potential BAC (DCu) hereof is 0.8 mg/l of Cu2+, due to research associate the problems related to the occurrence of cirrhosis in young people in India who consume these low pH waters (WHO, 2005).

But in small doses, copper is essential for various redox enzyme processes, hemocyanin and superoxide dismutase, strengthens arteries, the immune system and assists the Fe in the synthesis of hemoglobin (Underwood, 1977). Epidemiological studies are demonstrating their disability relationships to increased levels of cholesterol, occurrence of cardiovascular diseases, osteoporosis, aneurysm and free radicals (Castrejon, 2011).

As well as Fe, Zn2+ and Se2+ has positive correlation in diets for the pulmonary functions and its antioxidant effects in the prevention of lung cancer (Pearson et al., 2005; Mahabir et al., 2007). Such correlations have also been observed in public drinking water (tap waters) containing noticeable concentrations of copper, in a population of 297 people (Sparrow et al., 1982).

However, all these elements tend to be disabled due to inadequate diets children in less developed countries, leaving them more susceptible to infectious diseases and physical or mental disorders. In premature babies, such deficiency can result in edema, anemia, leukopenia and ease of bone fractures (IOM, 1980).

These shortcomings also reach above 10% of the population of developed countries, as exemplified in 2000 study people of British Columbia (Canada) where 25% presented with such feature (Campbell, 2001). A historical evolution of this problem, related to lifestyle changes and especially in reducing these and other trace elements in processed foods and natural, which can cause mental diseases and disorders, displaying the covers the largest average decline rate (-62%) (Thomas, 2007).

Systematic physicochemical analyses of public drinking water consumed in 144 different cities of the United States showed that through the daily intake of 2 litres, for all elements evaluated, only 4 could provide up to 1% of your daily intake recommendations: Na+: 3%, 5%: Mg2+, Ca2+: 6% and 10%: Cu2+ being the average value of copper equal to 0.098 mg/l (Pehrsson et al., 2008).

Even so, such proportions corresponding to approximate concentration of 0.1 mg/l of Cu2+ do not indicate relevance of these drinking water as recommended nutritional supply everyday health (Barton, 2009). But its importance is likely to increase due to the decrease of minerals in foods.

So, the minimum content for this BAC in everyday consumption (DCu) follows search result in Boston (United States) where drinking water diet considered easily tolerable and beneficial to the circulatory system of copper supplementation in 0.46 mg/day via ingestion of 2 liters of water, or 0.23 mg/l Cu2+ (WHO, 2005).

Liquid diets, copper retention by the human body resides in the range between 25 to 28%, being greater than the bovine milk (Ekmekcioglu, 2000). As well as the electrolytes Zn2+, Se2+, Mg2+, Mn2+ and Mo2+ when dissolved in water, the copper occurs in the ionic form (Cu2+) complexed with organic ligands (IOM, 1980), possessing greater bioavailability on solid foods at physiological functions of metabolism, transport and excretion (Klevay, 1998; Duflot, 2007).

Results of consultation on the micronutrient covers database. standardized clinical trials provided 88 studies (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the words "mineral water" considered AND "copper" in the digital database http://www.ncbi.nlm.nih.gov/pubmed amassed 39 results.

10.6. Strontium (Sr^{2+})

The average concentration of strontium in igneous rocks is 375 ppm in schists is 393 ppm and in soil is 300 ppm. In the waters of oceans is 8 mg/l 0.06 mg/l rivers and in groundwater is 0.18 mg/l. the content of this element both in aquifers and surface waters is related to regional geology, being their largest concentrations related to limestone, dolostone, evaporites and alkaline volcanic rocks (Hem, 1989; Shvartserv, 2008).

In Germany, United States and Canada their concentrations in drinking water public approach of 0.35 mg/l and in groundwater, and bottled sources of these same countries in 1.3 mg/l of Sr^{2+} (WHO, 2010).

Has metabolic behavior similar to that of calcium and when dissolved in drinking water in the form of natural electrolyte, is more easily absorbed by the body, being between 25% and 30% of the total (Duflot et al., 2007). In this way, are not recognized negative epidemiological effects of strontium and its essentiality to humans has been demonstrated for decades, especially for research related to problems of osteoporosis, arthritis and dental health (Usuda et al., 2007).

Clinical trial of 4 weeks demonstrated the efficiency of drinking water consumption with approximately 15 mg/l of Sr^{2+}, in the improvement of osteoporotic frames in postmenopausal women and in the elderly, bone strengthening to reduce common fractures in this age (Marie et al., 2001). Some studies consider how epidemiological strontium concentration great in drinking water to prevent tooth decay, values between 5 and 10 mg/l, in association with F-and Ca^{2+} (Lippert and Hara, 2013).

In work carried out in the region of Saint Petersburg (Russia), it became evident the presence of strontium dissolved in 1.4 mg/l in water of STD 1200 mg/l of occurrence in the Sanatorium Petrodvorets, where hydrotherapy is particularly applied in the treatment of tuberculosis (Voronov and Vinograd, 2009).

However, as initial content of medical biological activity (MSr), the option is in the fountain hidromineral La Roche-Posay (France), due to quantity and consistency of analytical papers published specifically on the effectiveness of mineromedicinal water related to the presence of selenium and strontium in medium total residue (595 mg/l STD). Clinical study conducted with this water considered rich in these two elements, 0.05 mg/l of Se^{2+} and 0.3 mg/l of Sr2 , demonstrated their ability in the anti-inflammatory treatment of eczema and psoriases (Celerier et al., 1995).

As minimum content necessary for bioactivity in external display (BSr), adopts the value of 7 mg/l of Sr^{2+}, used also as balneoterapêutico parameter for a source be regarded as local municipalities of potential interest in installing a SPA in Iraq (Al Dulaymie et al., 2011). In this type of application of water, strontium has demonstrated in dermatology power to inhibit keratinocyte derived from cytosines (inflammatory Tölgyessy, 1993; Laguarda, 2002).

The hydrochemistry evaluation in bottled mineral waters of Japan 33, presented a medium content of strontium in 0.094 mg/l of Sr2+, with large standard deviation and positive correlation relative to the elements calcium and magnesium, which may indicate the no human interference in the sources. This work was suggested to this potential nutritional food with benefits in chronic renal insufficiency and other problems of population aging (Usuda et al., 2006). Thus, this value will be selected here as minimal bioactivity dietetics (DSr).

The average value observed in the diet of adults is 1.5 mg/day, constituting the normal contribution of drinking water at 10% of total consumption, so that the selected content seems compatible. To its ceiling, using the recommendation EPA (United States Environmental Protection Agency) for drinking water with 4 mg/l of Sr2+ (WHO, 2010), which coincides with its value for drinking water in communities where noted public better conditions of glazes and lower rates of dental cavities, one of 58 compared in North American study (Curzon and Crocker, 1978).

Queries the database for standardized clinical trials about the strontium micronutrient resulted in 24 studies (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the key words "mineral water" AND "strontium" http://www.ncbi.nlm.nih.gov/pubmed database resulted in 4 publications.

10.7. Total Iron (Fe)

The mean concentration of iron in igneous rocks are schists, 56300 ppm is parts per million by calcarios 47200 is 3800 ppm and in soils of 38000 ppm. In the waters of oceans is 0.0034 mg/l 0.5 mg/l for rivers and groundwater is 0.48 mg/l. in aquifers is anaerobic-type in the form ferrous (Fe2 +) more soluble. Public potable waters average values of iron are rarely in excess of 0.3 mg/l (Hem, 1989; WHO, 1993; Shvartserv, 2008).

In several countries with laws crenotherapy this element classifies as ferruginous mineral waters "chalybeate" or when your content is above 1 mg/l of Fe2+. Are fairly common associations with manganese and in particular with arsenic, being termed as a subtype arsenic-iron (Albertini et al., 2007). When in shallower environments, also tend to be present in the other three main bicarbonate anions, chloride and sulfate (Popoff, 2010).

In this way, is found large number of bibliographic references focusing on their therapeutic benefits and biochemical activities. Among them, in England, are recognized sources of iron Bath with 1.45 mg/l and the Tunbridge Wells in Wealden with 27 mg/l Fe (O'Hare et al., 1985). In France, the source of the renowned ferromanganífera SPA of Luxeuil-les-Bains which is historically used for rheumatologic treatments, gynaecological and circulatory system displays approximate content of 1.95 mg/l Fe (Lacroix and Aboyans, 2005). In the historic Belgian city of Spa, the Sauvenière Source holds water with up to 24 mg/l Fe.

Evidence has been found on the activity of peroxidase or catalytic oxidation that occurs in natural mineral waters of Saratoga Springs (United States), as continuous chain reaction, initiated due to the presence of iron in its ionic form and with important biochemical components (Cronheim, 1948). This work is the selection of the minimum value of bioactivity of medical element (MFe), being assigned the source Hathorn, who owns content of 1.84 mg/l Fe (Kitto et al., 2005).

The iron is responsible for oxygen transport in the blood, through the intermediary of hemoglobin and is present in some cellular oxidation enzymes. Your referrals are related to anemia, weakness and States of nervous outburst (Nielsen, 2003) (ANNEX TABLE CRENOTHERAPY INDICATIONS).

In external use or baths with mineral term waters, the elements copper, manganese and iron have recognized power of cutaneous permeation, being nominated against acne and eczema (Laguarda, 2002). As minimum value for bioactivity balneoterápica (BFe), his estate and astringent benefits in the treatment of alopecia, follows the suggestion for locales of potential first SPA facility in Iraq, with required content of iron in 0.84 mg/l (Al Dulaymie et al., 2011).

Makes up on average 0.1% of the human body, being in the form of ferritin and in greater proportion in the liver and the spleen. Essential element and also regarded as nutritional, was the first to receive trace mineral value of dietary recommendation by the World Health Organization, between 8 to 18 mg/day. little is known about its toxicity and epidemiological suggested the maximum consumption of 45 mg/l Fe to individuals prone to excessive storage of iron (hemochromatosis). Its bioavailability is estimated at 15% (WHO, 2005).

Iron deficiency and iron deficiency anemia affects more than 2 billion people worldwide, especially preschool children, women and pregnant women. And one of the main strategies to improve this situation is your dietary supply through food with high bioavailability, as the natural drinking water or enriched in this element. For developing countries, also an important supplement to assist in malaria endemic areas (Dutra-de-Oliveira et al., 2011).

Even in rich countries, such grace period reaches on average 8% of the population, as an example of the sampled group of research 2000 people of British Columbia (Canada) with 25% of findings (Campbell, 2001). Iron deficiency can cause anemia, infectious diseases, bleeding, immune system problems, parasites, weakness, chronic fatigue, insomnia, constipation, impotence and hair or brittle fingernails (IOM, 2001; Freeland-Graves and Trotter, 2003).

Systematic physicochemical analyses of public drinking water consumed in 144 different cities of the United States, show average value of 0.02 mg/l Fe (Pehrsson et al., 2008). As maximum value of bioactivity dietetics (DFe) will be considered the same acceptable for drinking water, without prejudice to your palate or visual aspect, being of 3 mg/l Fe (WHO, 2003).

Despite the value Guide to drinking water be minimal in 0.3 mg/l Fe, representing 5% of your total consumption typical (WHO, 1996), the choice of initial value of potential bioactivity dietetics is guided in the research described below.In research a year, with more than 1000 participants aged from a Chinese rural community, where life expectancy is high and the rate of mental illness below average in the country were analyzed 20 samples of your everyday consumption water sources for the components: Cd, Ca2+, F-, Fe, Pb, Se2+ Zn2+, and pH. The approach to health is the prevention of Alzheimer's disease and in the quality of cognitive functions, testing 30 items divided into groups: memory, language and attention. The main findings were positive correlations with concentrated waters in calcium (up to 86 mg/l), Fluorine (2.6 mg/l) and (DFe) iron (0.267 mg/l) (Emsley et al., 2000). (more CRENOTHERAPY INDICATIONS indications).

Queries the database for standardized clinical trials about the micronutrient iron resulted in 681 studies (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the key words "mineral water" AND "iron" in the specialized database prospectou http://www.ncbi.nlm.nih.gov/pubmed 55 results.

10.8. Fluoride (F^-)

The mean concentration of fluoride in basaltic rocks is 393 ppm in schists and limestones in 1960 's ppm is 330 ppm. In the waters of oceans is 1.3 mg/l, 0.1 mg/l for rivers and groundwater with 0.48 mg/l (Hem, 1989; Shvartserv, 2008). Their presence increases in soils according to the depth, into surface waters according to the climatic aridity and the groundwater by the presence of rocks with fluorite and may reach levels greater than 20 mg/l, normally in positive correlation to Na+ and Ca2+ negative (Komatina, 2004).

According to the European legislation for mineral waters, as well as from other countries, levels above 1 mg/l F- rank the same as fluoride waters. As a result, you may find large amount of scientific publications, mainly related to the skeletal and dental health (Queneau and Hubert, 2009).

In pharmacological experiment of 20 days with Guinea pigs, if administered curative water from the source in Ladek Zdzisław (Poland), being observed a statistically significant decrease of total cholesterol, HDL fraction, lípidios and triglycerides, demonstrating biological actions of this mineral water fluoridated with diuretic properties and metabolic diseases (Drobnik, 1999). So, if it adopts the content of 0.41 mg/l F- this water as minimum value (MF) bioactivity therapy (Chau et al., 2012).

As minimum value for bioactivity balneoterápica (BF) follows the minimum content of 2.4 mg/l F- adopted by North American standards of definitions for the SPA (Lund, 2000), which is slightly higher than the Japanese suggestion of 2 mg/l and 1 European mg/l F-.

In Canada, the average values of fluoride in drinking water natural public approach of 0.11 mg/l and in treated by fluorination of 0.7 mg/l F-. In the Netherlands, this figure is 0.2 mg/l F- (IOM, 1993, 1997). In the United States, studying in 288 samples of drinking water from different regions separates average 0.92 mg/l F- in public waters treated by fluorination of 0.44 mg/l F- for public waters not handled and 0.22 mg/l F- for water from wells (WHO, 2011).

Several studies have demonstrated that the presence of 1 to 1.2 mg/l of fluoride ingested water in daily life significantly reduces the percentage of dental cavities, and can contribute in hardening of the skeleton and the growth rates and fertility of animals. However, prolonged exposure to concentrations higher than 3 or 5 mg/l F- can cause damage to these very antagonistic biological characteristics, styling by chronic fluorosis (Bengharez et al.., 2012).

The typical contribution of fluoride via ingestion of drinking water is of 40% of the total, being dissolved to 0.3 mg/l F- (WHO, 1996). Even with the differences related to the characteristics of individuals and the other components associated with fluoride at each water, takes as its ideal content for human consumption Dietetic values between 0.7 mg/l and 1.5 mg/l F- (Sharma et al., 2013). It is worth mentioning the quote a few Brazilian groundwater containing such value, i.e. less than 10% of bottled mineral waters in the country (Villena et al., 1996).

As minimum value for potential biological activity nutrition (DF) is considered to be the same as in the previous work, however, as ceiling in this variable is in relief the scope of investigation for a year, with more than 1000 participants aged from a Chinese rural community, where life expectancy is high and the rate of mental illness below the average in the country. 20 font samples were analyzed with waters of everyday consumption for Cd components, Ca2+, F-, Fe, Pb, Se2+ Zn2+, and pH. The approach to health is in risk and prevention of Alzheimer's disease and in the quality of cognitive function testing 30 items divided into groups: memory, language and attention. The main positive findings are in correlation with concentrated waters above 2.6 mg/l F- (Emsley et al., 2000).

The fluorine belongs to the group of nutritional substances that have cumulative properties and as an essential element is more concentrated in the teeth and bones of animals and of man; although trace amounts are present in the thyroid gland and skin. Of the total fluoride content, about 96% is stored in bone tissue (Nielsen, 2003).

Queries the database for standardized clinical trials about the micronutrient fluoride resulted in 234 studies (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the key words "mineral water" AND "fluoride" http://www.ncbi.nlm.nih.gov/pubmed database provided 50 results.

10.9. Lithium (Li^{+})

Lithium has how average concentration in igneous rocks 20 ppm in schists 66 ppm and 30 ppm in soil. In the waters of oceans is 0.17 mg/l 0.002 mg/l for rivers and groundwater with 0.013 mg/l (WHO, 1993; Shvartserv, 2008). Its occurrence is common in hot springs and the largest concentrations are in volcanic regions with extreme pH (Komatina, 2004).

To check the minimum value of bioactivity lithium therapy in natural water (MLi) are diverse regions with research on health effects through the daily intake of drinking water and/or public health sources, with the minimum level of 0.07 mg/l Li+. In France, bottled waters considered litinadas that have approximately this level are: Source Romaine, Chambon La Foredt, Contrexville and Martigny-Les-Bains.

In bibliographical compilation about various samplings in Japan are suggested anti-aging effects and mortality reduction for different animals, including humans (Zarse et al., 2011). In public drinking water from seven districts of Austria, it was found that the increased content of 0.01 mg/l Li+ occurs decreased suicide rate at 7.2% of the total population (Kapusta et al., 2011). In 27 cities of Texas (United States), where the lithium content is between 0.07 and 0.17 mg/l, study conducted during five years indicated that the average number of murders, suicides and drug dependencies is less than in other communities (Schrauzer, 2002). The average number of suicides in 18 locations in the region of Oita (Japan) with public drinking water more rich in lithium, also is smaller (Ohgami et al., 2009), a fact also defended globally by Helbich et al. (2012).

By presenting bioactive effects in baths, probably related to lithium in its waters (Morse, 1887), the source Lithia (British Columbia/Canada) represents here the minimum balneoterápico content (BLi). Research of randomized clinical trial in 15 participants who during eight weeks drank only water that fountain, with 0.68 mg/l Li+, indicated effective improvement in neurogenesis and antioxidant capacity, measured by serum levels of brain-derived neurotrophic factor and markers of oxidative stress, and changes in mood, cognition and well-being (Lam, 2012).

The maximum recommendation for drinking water is of 0.7 mg/l Li+ (Usuda et al., 2007), which is also adopted as the threshold of bioactivity in diet (DLi). The values of lithium in human diet are: minimum 0.022 mg/l; medium 0.038 mg/l and maximum 0.107 mg/l (WHO, 1996). Lithium is the trace element in this work of greater contribution to normal diet recommended to humans through the consumption of drinking water, with 24.3% of the total (Houssein, 2011), the minimum value of this bioactivity (DLi) for maximum contribution is 0.012 mg/l.

Lithium participates in important biochemical processes such as breathing nuclear membranes in intracellular level, glucose uptake in cells, production of monoamine oxidase from the depressed liver and serum activities of isocitrate dehydrogenase, malate, glutamate dehydrogenase and aldolase (Nielsen, 2003).

Their physiological activities involve the retention of liquids, inhibition of cholesterol synthesis, water-electrolyte system balance and circulation (Tubek, 2006). Has effectiveness observed in sodium imbalance treatment on atherosclerosis, hypertension, alcoholism, mental disorders, depression, heart disease, improving learning performance, fertility, growth rate and longevity (Duflot, 2007).

Queries the database for standardized clinical trials about the micronutrient lithium resulted in 208 studies (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the key words "mineral water" AND "lithium" on database http://www.ncbi.nlm.nih.gov/pubmed illustrated 10 results.

10.10. Manganese (Mn^{2+})

Manganese has greater concentration in igneous rocks with 950 ppm in schists of 850 ppm in acidic humic soils and is less than 850 ppm. In the oceans, has 0.0004 mg/l, one of the lowest average concentrations of the trace elements in relation to those found in the waters of rivers (0.02 mg/l) in groundwater (0.005 mg/l) and even in aquifers in an acidic medium (0.05 mg/l) (Hem, 1989; WHO, 1993; Shvartserv, 2008).

Mineromedicinal water sources, their occurrence is often associated to types classified as arsenic-iron (Albertini et al., 2007). To check the content with potential bioactivity therapy (MMn) using the example of the French resort Luxeuil-Les-Bains, a water supply ferromanganífera Bénédictins with STD 1500 mg/l and MN dissolved of 0.06 mg/l, as indicated by the Bursaux sources and Forage for venous infections, rheumatology and gynaecology (Lacroix and Aboyans, 2005).

Through clinical trial in 70 patients with symptoms of topical dermatitis, used 2 thermal baths per day immersion in water of Japan acid source with natural dissolved manganese content of 1.4 mg/l, obtaining control in 76% of cases (Kubota et al., 1997). So, this is the value of bioactivity balneoterápica selected (Okay).

The main biological effects in therapeutic uses manganese topics contained in thermal or mineral waters is in cell renewal, healing, bactericidal and cutaneous barrier recovery (Nunes and Tamura, 2012). Also through the balneotherapy, has assigned power of cutaneous permeation, participating in the synthesis of macromolecules glicosaminglicanose dermal and tirosinasa, being enzyme activator and immunological functions (Laguarda, 2002).

Considering the public drinking water with a typical concentration of 0.04 to 0.064 mg/l of Mn2+, its contribution to the total daily recommended consumption is only 3%, being the amount of 1.32 mg/l equal to the amount of solid foods (IOM, 1980). Systematic physicochemical analyses of public drinking water consumed in 144 different cities of the United States showed that the average value is 0.002 mg/l of Mn2+, whereas in Germany this value is 0.02 mg/l for Mn2 + (Pehrsson et al., 2008).

Several papers consider the most appropriate value for the dissolved manganese in drinking water is 0.4 mg/l, corresponding to 20% of the total dietary recommendation (WHO, 2011). The minimum dietary value (DMn) adopted here will be 0.2 mg/l for 10% of the total, and the maximum shall be equal to the contribution of solid foods.

Along with Selenium and molybdenum, constitutes nutritional option for newborns and children due to their low content contained in milk (WHO, 2005). Although manganese is relatively non-toxic, much can interfere with the absorption of other minerals, such as iron.

Manganese is essential for all living organisms known, activates numerous enzymatic systems, including those who are involved in glucose metabolism, energy and production of superoxide dismutase (main constituent of metalloenzymes, hormones and proteins). Is required for the normal function of the brain, muscles, bones, cartilage and blood; In addition to the synthesis of cholesterol, fat, glucose, DNA and RNA (Hambidge, 2003; Ames et al., 2005).

Conditions possibly associated with manganese deficiency include osteoporosis, rheumatoid arthritis, Lupus Erythematosus, allergies, diabetes and alcoholism, as well as deafness, asthma, repetitive motion syndrome, seizures, loss of libido, infertility, miscarriages and decreased growth rate (I, 1999; Nielsen, 2003; Freeland-Graves and Trotter, 2003; Tubek, 2006; Bailey et al., 2011).

But, in the same way as for several other trace elements, their nutritional deficiency occurs in various parts of the World, following the example of the evaluation carried out in 2000 people of British Columbia (Canada) where if found in 40% of cases (Campbell, 2001).

Queries the database for standardized clinical trials about the micronutrient manganese resulted in 17 studies (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the words "mineral water" key AND "manganese" in the database is enumerated http://www.ncbi.nlm.nih.gov/pubmed 14 results.

10.11. Molybdenum (Mo^{2+})

Despite being almost always present in terrestrial materials, the concentration of molybdenum is remarkably small, in fosfáticas rocks is of 30 ppm in black shale is 10 ppm, in sea water is 0.01 mg/l, water from rivers 0.0004 mg/l, groundwater is 0.003 mg/l and in public drinking water between 0.0001 and 0.068 mg/l of Mo2+ (Hassoun, 2011).

The inorganic form in which molybdenum occurs in waters (MoO42 molybdate −) is almost completely absorbed by the body (84% to 98%) and move internally and externally in a way very fast, being also excreted through the urine in this same speed (Chappell et al., 1979).

Studies in three distinct regions (Colorado and Ohio/United States and Dunedin/New Zealand) where we consumed water with molybdenum content above 0.045 mg/l, indicated increased physiological uptake of fluoride and strontium, with population reduction cariostática (Losee and Adkins, 1968). This being the minimum value recommended against their disability (Freeland-Graves and Trotter, 2003) and that shown here as a reference of bioactivity (MMo).

No reference has been found on its bioactivity in external or external uses.Just like fluoride and selenium, molybdenum has rather small interval between its minimum value and the maximum essentiality for toxicity (Plant et al., 1996). There are few reports by his intoxication, is essential to all living things and rare natural occurrences with water levels above 0.02 mg/l, the maximum recommended guide value for drinking water is 0.07 mg/l of Mo2+ (WHO, 2011). The consumption of water containing 0.005 mg/l of Mo2+ can contribute up to 20% of your recommended daily needs (WHO, 1996) and, therefore, this will be the value considered nutritional interest (DMo)

.Its deficiency, found at up to 15% of the population of developed regions as in British Columbia (Canada) (Campbell, 2001) may entail in cancer of the esophagus and stomach, increased cholesterol, tachycardia, night blindness (EFSA, 2012) and neurological disorders as children's disorders and depression (Naylor et al., 1985).

Along with Selenium and manganese, is nutritional option for newborns and children, due to the low content contained in milk (WHO, 2005).

Is a cofactor of enzymes that participate in important oxidation reduction reactions (oxidation of aldehydes and others), being analogous to the element manganese. The content found in the water of the Balneary of Ibirá/SP (0.011 mg/l) allows to infer its application in nutritional complementation of the treatments used by conventional medicine (Rocha et al., 2008).

Queries the database for standardized clinical trials about the micronutrient molybdenum resulted in 21 studies (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the key words "mineral water" AND "molybdenum" on database http://www.ncbi.nlm.nih.gov/pubmed provided 7 results.

10.12. Selenium (Se^{2+})

Being one of the elements of lower concentration in materials and water of the planet, even seascapes (<0.00009 mg/l), selenium has geochemical behavior similar to sulfur and its greatest concentrations are associated with volcanism and hydrothermal uranium deposits. In General, groundwater is the most rich in selenium: 0.00072 mg/l (Shvartserv, 2008).

Its value to potential bioactivity Therapeutics in waters has as a reference study of hydromineral fountains in SPAs of Galicia Spain, with the highest value quoted from 0.04 mg/l of Se2+ being here adopted as minimum standard (MSe). For your use hidropínico (ingestion) is reported the antioxidant effect beside the enzyme glutathione peroxidase and increase in thermal therapy improved psoriasis and Atopic Dermatitis (Shai et al., 2010).

For bioactivity of selenium in water via external display (topical), balneotherapy or nebulized (BSe), the content is referenced to the source La Roche Posay (France), containing 0.053 mg/l of Se2+ and STD of 595 mg/l. There is evidence of effectiveness against free radicals, anti-inflammatory action, anti-pruriginosa, protector of ultraviolet rays, psoriasis therapeutic and healing of oral problems (Celerier et al., 1995; Lévèque et al., 2002).

The main biological effect on the types of therapeutic uses of selenium contained in thermal or mineral waters is in the recovery of Seborrheic Dermatitis, Tinea versicolor, reduction in the appearance of skin tumors and lipid peroxidation suppressed in the membranes (Nunes and Tamura, 2012).

Selenium is key component of several enzymes, including glutathione reductase, Iodothyronine deiodinase, thioredoxin reductase. As micronutrient essential for human health, constituting the Active Center with about 20 eukaryotic proteins highly relevant in biochemistry, mainly for redox state regulatory properties (WHO, 2005).

It has been shown that inadequate consumption implies the emergence and progression of chronic diseases such as hypertension, diabetes, coronary heart disease, asthma, cancer, rheumatoid arthritis, muscular dystrophy, senility and infertility (Millan et al., 2012). Also seems active in nutritional dietary intake levels above, in aid of deficiencies related to vitamin E and especially in the field of cancer prevention or in pharmacology as adjuvant treatment of some types of this disease (snow, 2002).

But, in the same way as for several other trace elements, their nutritional deficiency is quite common around the world, as in evaluation in 2000 people of British Columbia (Canada) where it transpires in 40% of cases (Campbell, 2001). Beside molybdenum and manganese, is nutritional option for newborns and children due to the low content contained in milk (WHO, 2005).

This element is present in the waters under the ionic form of selenite or selenate (Duflot, 2007). The most common drinking water consumption with 0.01 mg/l of Se2+, corresponds almost 11% of that is indicated to humans, but in countries with poor soils in this element (New Zealand), such contribution may reach over 50% of this diet with the same content contained (IOM, 1983b).

As an option of dietary bioactive selenium content dissolved in drinking water (DSe), the interval between 0.05 and 0.125 mg/l of Se2+ was selected by the search results in a population living in a rural community of Colorado (United States), where none of the 85 health parameters measured were changed (IOM, 1980). The minimum value recommended to prevent nutritional deficiency is 0.055 mg/l of Se2+ (Freeland-Graves and Trotter, 2003).

Queries the database for standardized clinical trials about the micronutrient selenium resulted in 126 studies (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the key words "mineral water" AND "selenium" http://www.ncbi.nlm.nih.gov/pubmed database evolved into 8 results.

10.13. Vanadium (V^{2+})

Vanadium has greater concentration in igneous rocks with 200 ppm in soil humic acid is greater than 100 ppm and in some fossil deposits of oil and coal. In the oceans in average is 0.002 mg/l in groundwater with 0.0013 mg/l and in the superficial is 0.0009 mg/l to V2+ (Bertrand, 1950). In United States ' public drinking water, its average value is 0.0045 mg/l.

Using in public drinking water of guinea 21 Japanese cities (Kanagawa, with 0.023 mg/l vanadium, and here selected as minimum value of bioactivity (MV) noted increased transportation and improvement in glucose metabolism, reduction of cholesterol metabolism and hyperglycemia associated with diabetes (Ding et al., 2001). Later study, also indicated the improvement of liver insulin receptor underActive by daily intake during 12 weeks of spring water Fuji (Japan) that owns 0.065 mg/l to V2+ (Kato et al., 2004).

Work carried out in human liver cells with waters sampled from two sources which has become the island of Jeju (South Korea) with vanadium contents of 0.026 0.009 mg/l and mg/l, demonstrated effectiveness related to the stimulant effects on the expression and activities of antioxidant enzymes such as superoxide dismutase, catalase, glutathione peroxidase and heme oxygenase, and may thus be promising its use in the treatment of diabetes (Kim et al., 2012; Hwang and Chang, 2012) and important agent in cancer prevention (Bishaye and Chatterje, 1995).

With these same waters, laboratory tests were carried out in rats under high-fat diet, suggesting its application as anti obesity agent due to inhibition of adipocyte differentiation (Park et al., 2012).

The minimum value of bioactivity dietetics (DV) adopted corresponds to the lower concentration among the sources of Jeju (South Korea) with 0.009 mg/l to V2+, due to the daily consumption of 2 liters of water represent almost the maximum contribution in typical diet of 0.022 mg/l to V2+ (IOM, 1980) and prevent their disability which requires 0.018 mg/day of V2+ (Freeland-Graves and Trotter, 2003).

The limit of its value is suggested in 0.18 mg/l, by 20% match maximum recommendation tolerated of vanadium in diet for women of 1.8 mg/day (IOM, 2001).

Clinical diseases associated with vanadium deficiency include: slow growth, increased infant mortality, infertility, high cholesterol, high triglycerides, hypoglycemia, hyperinsulinemia, diabetes, cardiovascular disease, atherosclerosis and obesity (Nielsen, 2003; Tubek, 2007; Duflot, 2007).

No reference has been found on its bioactivity in external uses.Is object of interest among nutritionists due to membership in the normal maintenance of various bodily functions, interfering in enzymatic systems of different ATPases, proteins kinases, phosphatases and ribonucleases. The disabilities points to several physiological dysfunctions including those of the thyroid gland, glucose and lipid metabolism.

The content found in the water of the Balneary of Ibirá/SP (0.09 mg/l) allows to infer its application in nutritional complementation of the treatments used by conventional medicine (Rocha et al., 2008).

Queries the database for standardized clinical trials about the micronutrient vanadium resulted in 2 studies (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the key words "mineral water" AND "vanadium" on database http://www.ncbi.nlm.nih.gov/pubmed extracted 4 results.

10.14. Zinc (Zn^{2+})

Zinc has greater concentration in igneous rocks of 70 ppm, in schists of 95 ppm and in soils with 50 ppm. In the waters of the oceans has 0.005 mg/l, 0.02 mg/l for surface and groundwater of 0.038 mg/l (Hem, 1989; Shvartserv, 2008).

Is one of the most important trace elements, working in a wide variety of human biochemical processes, supporting metabolic catalysis, cellular structures and more than 300 enzymatic actions (Wintergerst et al., 2007). Your nutritional deficiency brings serious health problems, weakens the immune system and increases the risk of chronic diseases such as hypertension and diabetes (Ames et al., 2005).

Your grace period is observed in most of the world's population and its evolution has been studied in epidemiological studies that associate the current lifestyle (stress and pollution), decreased food base element due to environmental scarcity and dietetics, quickness of the productive process, deficiency in younger animals, decrease in human absorption efficiency at more advanced ages, dietary practices for newborns (Hambidge, 2003) and even the lack of its supplementation in aqueous form which is more bioavailable, natural and associated with other micronutrients (Duflot, 2007).

The problem worsens in children of the poorest regions, for example, inhabitants bordering the Amazon River where the food base is in freshwater fishing (WHO, 1996). But also reaches above 10% of the population in rich countries like the USA and Canada, for example, British Columbia with 47% of disability in population of 2000 people sampled (Campbell, 2001).

The drinking water may contribute to this daily supplementation, because zinc, when in appreciable levels, typically are in their inorganic Ionic (electrolyte) of the milk and the superior bioavailability over twice that of solid foods (Ekmekcioglu, 2000). Thus, also interacts with other electrolytes in pró-biótico factor and potentiates their digestive absorption (WHO, 2005).

Mineral waters containing zinc regulate blood pressure, lowers high blood pressure and protect against harmful effects of elements such as Cd and Pb. However, as for all trace elements, liquid foods typically contribute with only 7% of the total intake, against 97% of solids (Tubek, 2006).

With an average concentration of dissolved zinc in drinking water estimated at 0.2 mg/l, when consuming two liters per day, an adult will supply only 3% of the minimum required of this element, corresponds to 11 mg/day (IOM, 1980). In special cases, this value may reach 31.2% for vegetarian diets and ingestion of bottled mineral waters of high mineralization (STD > 1000 mg/l) of the German market (Hassoun, 2011). Systematic physicochemical analyses of public drinking water consumed in 144 different cities of the United States indicated that average value is 0.05 mg/l of Zn^{2+} (Pehrsson et al., 2008).

The search for levels of bioactivity of this essential element as natural electrolyte usually indicates values below the unit of mg/l, i.e. at least ten times lower than the recommended reference for human consumption journal. Largest concentrations in freshwaters can occur associated with mineromedicinal sources of type arsenic-iron (Albertini et al., 2007). Not being found work on therapeutic properties of zincíferas waters, adopt their contents in oligominerais water or medium mineralization referred to as therapeutic sources, supplying potable epidemiological deficiencies and used externally as dermacosmetics.

The content of zinc and copper was analysed in deemed therapeutic waters 12 and compared to that of bottled mineral waters of Poland 13, where stands out the source Mazowszanka containing 0.088 mg/l of Zn^{2+} and STD of 688 mg/l. However, consisted not in this job descriptions of related biological activities (Kot, 2001). Recent pharmacological tests in this country have shown that mineral waters containing Zn^{2+} and Si are effective in cell regeneration and adaptation in post-arrest period (Korolev et al., 2012).

Due to the comprehensive illustration of their effectiveness, minimum levels considered necessary for potential medicinal bioactivity (MZn) of zinc in electrolytic form (Zn^{2+}) follow research where 0.0196 mg/l of this element dissolved in saline aqueous solution is used as anti-inflammatory and/or immunosuppressive (Tanaka et al., 2005).

For the maximum level of daily nutrient intake (DZn) the reference guide of 3 mg/l is used, this content also brings taste astringent waters (WHO, 2011). And to the least potentially bioactive, is assumed to be the set of epidemiological research relating public drinking water, with effectiveness in reducing incidence of juvenile diabetes type 1 diabetes mellitus in certain regions.

Among the elements evaluated are: Mg^{2+}, NO_3, Fe, Al^{3+}, Si, pH and having been prioritized the Zn^{2+}. The inverse or negative correlation of their concentration in drinking water daily and the number of younger patients is evidenced in controlled studies with hundreds of participants and during long-term (10-year >) in England (Zhao et al., 2001), Norway (Stene et al., 2002), Poland (Barton, 2010) and Sweden (Samuelsson et al., 2011).

The minimum values used were: 0.027; 0.075; and 0.0367 0.14 mg/l of Zn^{2+}, respectively.

The benefits of zinc for the skin are widely recognized in pharmacology and in balneotherapy are described their participation in nucleic acid synthesis and metabolism of vitamins and vitamin A (Laguarda, 2002). In aesthetic medicine and cosmetology, are evidenced the biological effects of zinc contained in thermal or mineral waters in uses topics: antioxidant, cell renewal, modulation of inflammation and strengthening the system of defense against free radicals (Nunes and Tamura, 2012).

In balneotherapy, zinc and other trace elements (Br, Rb) present in the mineral waters has good penetration ability in skins with psoriasis (better than healthy skins) and great effectiveness in the treatment of infections, being necessary content, among the parameters balneoterapêuticos for a source of potential first health SPA facility in Iraq, to less than 0.1 mg/l of Zn^{2+} (Al Dulaymie et al., 2011).

However, the minimum content here selected for balneotherapy (BZn) will be the same as the source of hidromineral Comano (Italy) with 0.043 mg/l of Zn^{2+} and 190 mg/l STD (Tabolli et al., 2009). Clinical study performed in 111 patients, through daily immersion baths for 2 weeks and fototerápico treatment (UVB) combined, demonstrated effectiveness for cases of psoriasis, as well as in the improvement of the quality of life of participants.

Research on specific database for standardized clinical trials about the micronutrient zinc resulted in 254 studies (http://clinicaltrialsfeeds.org). Database query published as "Clinical Trial, Journal Article and Review" with the key words "mineral water" AND "zinc" on database http://www.ncbi.nlm.nih.gov/pubmed stressed 24 results.

CHAPTER 11
HYDROGEOLOGY AND HYDROCEMISTRY

The estimate of the total mass of water on Earth involves an activity that occurs for more than 4 billion years, a significant percentage of which circulates up to the limits of the mantle and atmosphere. On his way the water participates mainly in subduction of tectonic plates, felsic, mineral crystallization, superficial and Atmospheric climate dynamics (Shvartsev, 2008).

The total mass of the Earth little water fluctuated from the Archean, increasing one and a half due to the resulting accumulation of mantle exhalations and increased oceanic surface concentration. Whereas the entire ocean water can circulate through the crustal rocks every 50 to 70 million years ago, was small his chemical dissociation in virtue of the whole dynamic of differentiations and geological reactions involved, as well as the importance of the oceans to the hydrosphere. In the Archean and Proterozoic rocks, the ocean was several times at levels of up to 2 km above the current and total surface area with predominance, when the planet might be called oceania (Sorokhtin et al., 2011). The table below summarizes the distribution of water on Earth.

WATER DISTRIBUTION ON THE EARTH

ENVIRONMENT	MASS H_2O ($x10^{24}$ g)	AGE (years)
Earth Planet	4,230	current
Hydrosphere	0,819	2,2 billion
Hydrosphere	2,230	current
Mantle	2,007	current
ocean	1,420	current
ocean	0,325	2,2 billion
oceanic Crust	0,358	current
oceanic Crust	0,385	2,2 billion
Continental Crust	0,396	current
Continental Crust	0,109	2,2 billion
Continental Hydrosphere	0,050	current

Source: Sorokhtin et al. (2011)

Hydrogeological cycle has the vast majority of the volume of water of all the Earth's water cycle, with the flow rate calculated in 10 terrestrial, 5x1018 g/year. This stream is able to upload material dissolved atmogênico, litogênico added, and biogenic order of 30x1014 g/year, or the equivalent in the area average of 0, 2x108 g/year/km2 (Drury, 1987).

It is almost certain that all terrestrial hydrosphere water current has appeared in endogenous processes during geological history. As a significant portion of its volume, surface during the Proterozoic and Phanerozoic, was returning to the mantle through subduction zones. Some water was also dissociated in hydration of the rocks of the oceanic crusts and another small portion by solar radiation in the upper atmosphere (Henley et al., 1984).

The current amount of juvenile water from the mantle is of 0.54 km3/year (or 0, 54x1015 g/year), representing a volume 4000 times lower than the total discharge rate of hydrothermal vents mid-ocean chains. Although flow rate 10 times higher than the emergence of water in arcs and active continental margins Islands, this participation is secondary in the total volume. Also considering that all surface water from subduction zones of tectonic plates, throughout geologic history, is estimated at 14 billion km3 (or 1, 4x1025 g), this corresponds to only 10 times the volume of the oceans. Thus, we can say that the vast majority of sources and thermo-mineral springs meteoric origin has not (Muffler, 1993).

Groundwater is the least mobile of the hydrological cycle. Their reserves were formed from the infiltration of surface water and the atmosphere, as well as by the condensation of water vapor on the ground and of magmas. While the total volume of atmospheric water is replaced every 9 days, of seas and oceans occurs on average every 2000 years and groundwater every 8000 years. Their rate of movement into shallow levels is 1 to 1000 meters per year and at levels with depths of 1000 to 2000 feet drops to 0.1 to 0.0001 m/year; mobility in rivers is an average of 5 miles/hour (Shvartsev, 2008).

The different types of groundwater are sourced in open and closed systems of rock-water controlled by the following factors: quantity ratio between both presence and CO2 pressure and temperature of the environments (Hyzhenko, 1999).

The modes of occurrence of the springs are: discontinuities and permeability of strata or more commonly through fractures and faults. The mechanisms that can induce your surgências are: hydraulic grade pressure, expansion of water vapor, dissolved gases, temperature differential and density (Stevanovic, 2010).

According to their origins, groundwater and springs, can be called (Szikszay, 1993):

1. infiltration or Meteoric: from soil infiltration of surface water precipitated and in small part by the condensation of atmospheric water vapor, rarely exceed 40°C temperature. When not moving at great depths can also be designated as vadosas;

2. endogenous or juvenile primaries: stored by condensation of water vapor escaped from the cooling of magma and may emerge to the surface through cracks in the crust in the form of hyperthermal sources or geysers. Can also be derived secondarily chemical reactions released by chemical reactions between crustal materials. Its composition depends on some of the rocks where percolating and more of the reactions and the volatile and magmas or genetically associated with lavas. It is estimated that on average 1 kg 10 g of H2O releases granite;

3. conated: marine origin that were trapped in sediments (muds, sands, etc.), but we don't usually keep the original composition.

Stagnant ground waters (lênticas) are: lakes, ponds, reservoirs and other types. The term hydromineral fountains or hydrothermal vents in Brazil does not necessarily mean only

Springs as the term "spring" in the us therefore here can also be regarded as places of abstractions about the waters of springs, shallow wells, deep or jorrantes, which preserve and use its natural properties.

Continental everywhere (least Antarctica) are estimated over 57,000,000 of springs, being more than 100,000 thermals, i.e. approximately 0.4 and 0.00007 occurrences per Km2, respectively (Pèrez, 1996; Komagata et al., 1970).

Some countries have knowledge about large number of springs and thus a high density of these occurrences, such as: Portugal with 1,500 (2.3/Km2), Finland with 25,000 (1.3/Km2), Japan with 2,000 (0.8/Km2), Germany with 2,760 (0.76/Km2), New Zealand with 1,650 (0.25/Km2), Spain with 17,305 (0.05/Km2), Romania with 3,000. In countries with large span, has: China with 2,500 (0.0026/Km2), India with 300 (0.0009 per Km2), with Australia 5,000 (0.015/Km2), USA with more than 20,000 (0.05/Km2) (Glazier, 2009). For Japan has been described up to 27,000 (Serbulea and Payyappallimana, 2012) and Brazil's estimate of 1,322 springs (0.0019/Km2) (Frangipani et al., 1995).

In order to also assist in the development of this national water knowledge, this work was built the database with hidroquímicas analyses of health sources in 525 Brazilian municipalities (ANNEX TABLE 11. DATABASE SPRINGS BRAZIL). In the following tables the total data obtained for each variable, the average and maximum values:

ESTATIST	l/h	ºC	STD	pH	H_2S	CO_2	O_2	^{222}Rn	DUR	Si
AVER	92527	29,4	545,4	7,09	1,82	150,1	5,32	163,2	135,3	23,5
No	*306*	*456*	*419*	*425*	*78*	*140*	*70*	*195*	*292*	*321*
MAX	*5833335*	*70,0*	*10536,0*	*10,70*	*12,00*	*2188,0*	*10,00*	*3300,0*	*4117,6*	*285,0*

ESTATIST	Cl^-	HCO_3^-	SO_4^{2-}	F^-	Br^-	Na^+	Ca^{2+}	Mg^{2+}	K^+	Fe T
AVER	121,5	124,1	89,8	1,584	2,644	116,5	35,8	11,2	9,5	0,355
No	*392*	*383*	*381*	*248*	*57*	*382*	*380*	*381*	*377*	*216*
MAX	*3604,3*	*3650,0*	*6015,9*	*147,000*	*57,040*	*3200,0*	*2039,0*	*507,2*	*436,0*	*18,800*

ESTATIST	Al^{3+}	Ba^{2+}	B^{3-}	Cu^{2+}	Sr^{2+}	Li^+	Mn^{2+}	Mo^{2+}	Se^{2+}	V^{2+}	Zn^{2+}
AVER	0,178	0,108	0,351	0,013	0,638	0,114	0,066	0,008	0,048	0,025	0,029
No	*128*	*178*	*78*	*78*	*165*	*107*	*123*	*26*	*30*	*31*	*95*
MAX	*2,100*	*1,746*	*4,850*	*0,300*	*40,400*	*3,110*	*1,523*	*0,050*	*1,000*	*0,135*	*0,205*

Despite the many classifications based on bioactivity therapeutic or pharmacological effects of the waters since antiquity, many hydrochemistry ratings are related to their proportions or chemical groups and seek other explanations, such as physical or genetic. For example, there are the evaluations obtained through the graphs of Durov, Piper and Schoeller, among others (Shpeizert et al., 2010).

Data for other variables were incorporated into the database SPRINGS BRAZIL as latitude, longitude, altitude, geology, crenotherapy ratings of regional areas and provinces incasing hydrogeological, being thus possible the georeferencing and overlapping with the political maps, hydrogeological, tourist and climates (ANNEX MAP 8. HYDROGEOLOGIC PROVINCES WITH SPRINGS).

On these data, also performed calculations of electrolytic balance errors, ionic forces, ratings and large diagrams of Piper and Durov (Software Aq.Qa 1151-RockWare, 2006) (ANNEX TABLE 12. DATA SPRINGS BRAZIL EVALUATED).In order to compare results, assist in models, obtain more comprehensive and idea capturing anomalies, if compiled database of approved health sources, thermal, bottled and potable groundwater, from different countries, having been summarized the averages for the main physicochemical variables from more than 700,000 analyses (ANNEX TABLE 13. SPRINGS WORLD AVERAGES). In this comparison, some differentiations hidroquimicas are noted in more frequently, being the Brazilian minors sampling average levels of STD, Na + and HCO3- and the largest concentrations in Si, Al3 +, Ba2 + and B3-; being just a little more of Br-+ and Mn2, Fe. Some of these differences in trace elements were also noted by Costa et al. (2003); Barandas et al. (2011); Ranjith et al. (2011) and according to their minimum values bioactivity evaluated in international research, are relatively more numerous samples of selected SPRINGS BRAZIL on these parameters (other than fluorine and zinc) (ANNEX TABLE 16. BAC/MINERAL WATER SEGMENT PARAMETERS AND occURRENCES SPRINGS BRAZIL).

The proportion between the outcrops occurrences forms as springs are 52% to 48% of wells, which similar to those observed by national register SIGHIDRO (geographic information System) of the National Department of Mineral production (DNPM) of 56% sources 732 are springs and wells 44% (see table below). The lower values in the headwaters of STD, pH and temperature (ANNEX 9.1 DIAGRAM. DUROV BY OUTCROPS TYPES IN SPRINGS BRAZIL) that in the pits correspond to observations of Bertolo et al. (2007) and still observes that the springs have higher average levels of HCO3- and of radon dissolved (187.7 Bq/l) wells (135.3 Bq/l).

OUTCROPS TYPES OF MINERAL WATERS RESERVOIR (SPRINGS BRAZIL)

	OUTCROP	**N**	**%**
n	Springs	274	52
j	Gush Wells	50	10
p	Pits	201	38

N = Number of occurrences

As summarized in the table below, approximately 40% of the samples from SPRINGS BRAZIL are on Hydrogeological Paraná Sedimentary Basin Province and 30% in Eastern Crystalline Shield.

HYDROGEOLOGICAL PROVINCES AND SOURCES SPRINGS BRAZIL

#	**PROVINCE**	**LITHOTYPE**	**N**
I	Amazonas	Sedimentary Basin	22
II	Parnaíba	Sedimentary Basin	36
III	Paraná	Sedimentary Basin	203
IV	Costeiras	Minor Sedimentary Basins	31
V	São Francisco	Crystalline Shield and Minor Sedimentary Basin	33
VI	Setentrional	Crystalline Shield	3
VII	Central	Crystalline Shield	20
VIII	Centro-Oeste	Heterogeneous Sediments	7
IX	Oriental	Crystalline Shield	167

X	Meridional	Crystalline Shield	2

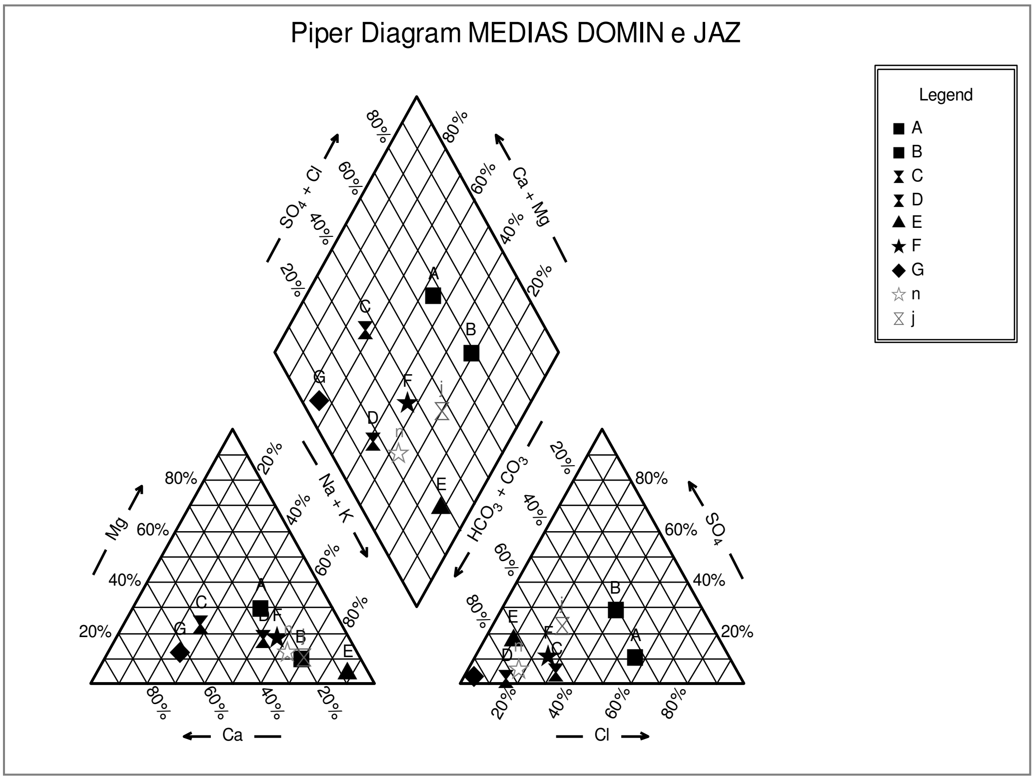
Source: MMA (2002)

Groundwater reserves of Brazil with volume stocked estimated 111,661 Km3, with 45% of it in porous aquifer of the sedimentary basin of Parana, 29% in the Amazon and 9% in fractured aquifer system which is larger the mantle of weathering (Rebouças, 2006). However, the Hydrogeological Domains is Crystalline where are 33% hydromineral fountains of SPRINGS Brazil and even greater percentage (70%) among the 732 registered for production in the SIGHIDRO database, while these sedimentary basins represent 43% of the total SPRINGS BRAZIL (table below) and 30% of Government inventory.

HYDROGEOLOGICAL DOMAINS AND SOURCES SPRINGS BRAZIL

DOMAIN	LITHOTYPE	AQUIFER	N
A	Cenozoic Formations	Porous	47
B	Sedimentary Basin	Porous	207
C	Porous/Fissure	Mixed	66
D	Metavulcano-sedimentary	Fissure	25
E	Vulcanic	Fissure	62
F	Crystalline	Fissure	104
G	Carbonate/Metacarbonate	Fissure	12

Source: CPRM (2007)



Average to 525 samples in SPRINGS BRAZIL database

Other hidroquímicas distinctions between these 2 main Hydrogeological Domains: B = porous and F = fissural crystalline, can be observed in the number of paintings with data obtained and average values of the SPRINGS BRAZIL, below:

DOM	ESTATIST	l/h	ºC	STD	pH	H_2S	CO_2	O_2	^{222}Rn	DUR	Si
B	AVER	126815	32,5	697,3	7,51	1,66	71,0	5,44	89,2	185,8	22,7
B	*No: 207*	*104*	*175*	*170*	*175*	*28*	*58*	*36*	*60*	*107*	*136*
F	AVER	18313	25,9	293,1	6,44	0,50	209,5	6,57	203,9	63,6	19,4
F	*No: 104*	*73*	*92*	*85*	*85*	*10*	*29*	*6*	*63*	*64*	*64*

DOM	ESTATIST	Cl^-	HCO_3^-	SO_4^{2-}	F^-	Br^-	Na^+	Ca^{2+}	Mg^{2+}	K^+	Fe T
B	AVER	146,6	127,8	169,6	1,352	6,749	170,6	42,5	10,1	8,7	0,349
B	*No: 207*	*171*	*164*	*163*	*109*	*17*	*166*	*164*	*164*	*162*	*77*
F	AVER	74,4	80,3	12,4	0,359	0,121	51,2	15,7	11,0	4,9	0,102
F	*No: 104*	*71*	*71*	*70*	*53*	*15*	*71*	*70*	*70*	*70*	*42*

DOM	ESTATIST	Al^{3+}	Ba^{2+}	B^{3-}	Cu^{2+}	Sr^{2+}	Li^+	Mn^{2+}	Mo^{2+}	Se^{2+}	V^{2+}	Zn^{2+}
B	AVER	0,139	0,082	0,404	0,013	0,963	0,338	0,080	0,011	0,121	0,035	0,027
B	*No: 207*	*34*	*68*	*46*	*49*	*60*	*32*	*36*	*8*	*10*	*12*	*50*
F	AVER	0,052	0,076	0,314	0,010	0,989	0,013	0,034	0,008	0,012	0,016	0,049
F	*No: 104*	*35*	*47*	*10*	*9*	*44*	*34*	*39*	*9*	*9*	*10*	*14*

Like the vast majority of samples are concentrated in the regions of highest population density, any geosestatísticas evaluations should be cautious. Despite the drafting of this database be prioritizes a better geographical distribution of SIGHIDRO where 33% of hydromineral fountains are in the State of São Paulo, BRAZIL SPRINGS samples are located by State (UF): AC: 6, AL: 7, AM: 12, BA: 33, EC: 19, DF: 2, S: 8, GO: 57, MA: 21, MG: 101, MS: 21, MT: 21, PA: 20, PB: 14, PE: 19, IP: 22, PR: 58, RJ: 27, RN: 17, RO: 11, RR: 3, RS: 33, SC: 41,: 4, SP: 113, TO: 12.

Mineral waters of the total 732 captures and envasamentos registered in the country are classified as: table drinking and low mineral (10%), alkaline bicarbonate (9%), soda-ferruginosa-magnesian-and alkaline-sulphurous-iron magnesium (1%), alkaline-undertone (5%), hipotermal, thermal and hipertermal (21%), bicarbonate-sulphurous and litinada and sulfated (1%), a radioactive source (22%), sulfur (1%), fluoride (27%), carbogasosa (3%) (Qiu, 2004).

Despite the low geothermal gradient, highlight the high flows in thermal springs from the Midwest, which is also known as "Hot Band of Central Brazil" (domo caldas novas), Toucan basin/BA, South Coast (intrusive suite and granitic batolito) of

Santa Catarina, basaltic Springs North Central Paraná, Paraná basin geoid anomalies, around the iron quadrangle, Espinhaço mountains and Chapada Diamantina (feathers), Tapajós River valleys, Tocantins, Amazonas, Marajó island in Pará.

Among some geothermal potential of Brazil: "HDR", uses shallow gravimetric anomalies direct, sismogênicas and neotectônicas areas, paleovulcões, astroblemas, resurgent tectonic, thickness (thinning), crustal discontinuities, late transcorrências in Goias, NW of Ceará, Pará-Maranhão. The correlation between distribution of hot springs, the heat flow anomalies and sismogênicas areas is indicated, among other authors, by Hamza (1982); Hurter et al. (1983); IPT (1983); Game (1984); Lamb et al. (1989).

The biggest potential geothermal reservoirs are the fields of large igneous provinces (LIP-Large Igneous Province) associated with our largest sedimentary basins, where all eyes return since the first studies of the national geothermal potential (Marques et al., 1978; Marques, 1981). Large amount of wells jorrantes is observed in the major sedimentary basins (especially of Paraná and Parnaíba).

There are still resources associated with alkaline ultramafic intrusion, and Goias State cretáceas the cenozoicas and (Hamza and Castro, 2004). Some thermal springs are related to Cretaceous alkaline igneous activity, and may include, among others: Six Lakes/AM, Juína/MT, Araxá/MG, Serra Negra/MG, Saltpetre/MG, Passa Quatro, Minas Gerais, Poços de Caldas/MG, Sacramento/MG, Montes Claros de Goiás/GO, Fernando de Noronha/PE, Arch of Bom Jardim de Goiás/GO, Caruarú/PE, PE/Snack, Itapirapuã/GO, Lages/SC, Anitápolis/SC, Kill black/PR and Admiral Tamandaré/PR (Schobbenhaus et al., 1984).

It is appropriate to note that some variables from components present in natural waters and with potential bioactivity have not been compiled here to avoid this work and also too enlarge due to lack of data, for example: microbiological conditions, NO3, PO4-3-, CO32-, I-, NH4 +, Ni2 +, As2 +, Cr 3 +, Hg2 +, Pb2 +, Co2 +, Ag +, Au +; natural organic components: ions of dimetílicos derivatives, polysulphide, C16 and C18 unsaturated fatty acid, 2-ethyl-1-hexanol, (1, 1, 3, 3-tetramethylbutyl) phenol (isomero), heneicosenol, s7, isopropyl myristate, 1-tetradecanol, s8, isopropyl palmitate, hexadecane, heptadecano, tetradecanoic acid, octadecan, 3-hexadecanol, 1-hexadecanol, n-hexadecanoic acid, eicosano, (e)-9-octadecen-1-ol, (z)-9-octadecen-1-ol, 1-octadecanol, (z, z)-octadecadienoic acid -9.2, (z)-9-octadecenoico acid, octadecanoic acid; amines/amides, esters, acids, alcohols, aromatic hydrocarbons aliphatic, alicyclic//heteroaromáticas hydrocarbons, elemental sulphur, anions polysulfides, phenols, alcohols, fatty acids long-chain saturated and unsaturated, carboxylic acids and alcohols, long chain n-alkanes, aldehydes, esters, ketones and elemental sulfur (Di Gioia et al., 2006; González-Barreiro et al., 2009).

CHAPTER 12
FINAL REMARKS

In the localities of hydromineral physiological influences sources begin by aspects of beauty and nature conservation or urban landscaping, knowledge of natural resources with therapeutic properties, favorable infrastructure and well adapted to these uses, as well as the historic practices and existing clinical trials.

The cities with some urban, historical approach of health tourism or appointment as health resort by legislation, were detected in 76 (a). With the potential for developing these activities suggested other 35 counties (b) and that have elements or natural resources for both, more municipalities 163 (d). Some cultural and historical relations with the Brazilian sources can be noted by the 86 locations (and) who have received names associated with warm waters and also in the miraculous waters sources compiled 44 (annexes: TABLE 9. MIRACULOUS FOUNTAINS and table 10. LocaLITIES WITH DESIGNATIONS OF HOT WATER IN BRAZIL).

Another important environmental aspect in the set of bioactivity potentially related to therapeutic health sources are the climatic factors, initially not polluted and basically controlled by latitudes, altitudes and macro-geográficos restrictions. Through the exchange of everyday atmosphere, with sedative effects or stimulants were differentiated 41 municipalities (THALASSO) with hydromineral fountains close to the coast and, therefore, where it can also be used in Thalassotherapy. High altitude locations already enough to physiological changes (above 1000 metres) are 12 (ALT) and only 1 mountain resort with over 1500 metres (MONT), in Campos do Jordão/SP.

To the concepts of bioclimatismo and climatotherapy are recorded in the environments where the climatic conditions or microclimate have extreme or differentiated characteristics of everyday habitat. This way, if they found 26 localities (EQUAT/SAV/ARID) with hydromineral fountains where their relative air humidity are very high (Amazon evapotranspiration) or too low (semi-arid). Also 21 were selected occurrences (TROPICSHock) of latitudes where heat is expected but due to the high relief have seasonality more mild. And hydromineral fountains where you expect the lowest temperatures, for being in the southernmost latitudes and simultaneously with altitude above 700 metres (CAPRICOLD), are found in 33 municipalities (ANNEX

TABLE 14. BAC LocaL ENVIRONMENTS AND CLIMATES: PARAMETERS AND occURRENCES).

The paths where percolating waters is also common sources the passage of gaseous free (undissolved), the dynamics of these fluids originates differentiated physical properties to surrounding environments. When in the form of radioactive emanations, these gases produce ionizing radiation phenomena that influence the behavior of other substances and biological activities. Several studies describe physiological benefits under exposure via inhalation or dermal in these atmospheres. In this sense, compile the SPRINGS BRAZIL emanations of radon (222Rn) along the 67 hydromineral fountains and in 49 instances the thoron (220Rn) is quoted, although only 14 of these possess the minimum level 26.8 Bq/l to classify them as torioativas.

The physical dynamics of a natural water source also is usually evaluated by constancy, volume and composition of its aqueous flow. The potential biological activities of these characteristics are in supply capacity, renewal and transport of water and its mineral, gaseous components, high-calorie or radioactive. Following the minimum flow parameter for the São Paulo resorts, over 4000 litres/hour if there are 58 natural emergencies (springs or wells jorrantes) in SPRINGS Brazil (flow) and only 8 of these thermals above 57 °C, which is currently the lowest temperature required for geothermal electric power generation.

But with enough heat for immersion baths and heating of environments enhanced by their good flows, may be considered 63 the hydrothermal vents ("hot springs"). As the passage of water through the human body can increase the dissolved radionuclides absorbed radiation, this hororradioatividade was here suggested as potential bioactivity in springs with flow exceeding 4000 liters/hour and where radioactive gases occur also issued a total of 33 sources (ANNEX TABLE 15. BAC PHYSICAL FLOWS OF GASES, FLOW, AND HEAT RADIATION: PARAMETERS AND occURRENCES).

Most of the components evaluated in this work (number 18 to 60) belong to waters from natural sources, physico-chemical properties are usually analyzed in laboratories or equipment and concentrating almost all of the studies related to potential biological activities positive with their observed values parameters in therapeutic clinical trials (MED), balneoterapias and external applications (bath/SPA/ONSEN) or nutritional studiesdietary and epidemiological, (NUTRI/DIET/EPIDEM).

For most of these components are correlated specific hidro-balneotherapy applications, based on traditional medicine crenologia and whose minimum efficiency levels are used to classify mineral waters in many countries legislation (LEG/WORLD) and Brazil (LEG/BRA). In this respect, considers itself worth noting that the similarities are greater than the differences between these international policies (ANNEX TABLE 7. MINIMUM VALUES OF CLASSIFICATIONS OF MINERAL WATERS IN INTERNATIONAL LAW).

Temperature, pH and total dissolved salts (STD) were subdivided due to observation in literatures and policies from different biological effects and therapeutic applications in these levels. As characteristics of the SPRINGS BRAZIL noted the predominance of warm temperature hipotermal, neutral pH, acid and low mineral type as for the total dissolved salts. Among the elements are silicon and barium, then fluoride, aluminum and manganese, but also deserving attention the radon, zinc and vanadium (ANNEX TABLE 16. BAC IN HYDROMINERAL FOUNTAINS: PARAMETERS FOR SEGMENTS AND occURRENCES).

The principles of therapeutic equivalence and bioequivalence of taxonomic similarities are described in pharmacopoeias as potential indicators of active pharmaceutical ingredients compared for its therapeutic effects, biopharmaceutical and biological potential classifications (WHO, 2010; Brazil, 2010). On this basis, were here described scientific research about clinical trials, pharmacodynamic analyses, assessments and nutritional epidemiological studies related to potential biological activities beneficial to health, quantified to 60 components (BAC) that can be present in hydromineral fountains.

By searching these minimum values for BAC in hidroquímicas compositions compiled from hydromineral fountains described analyses in Brazil, were identified more than 3000 results with potential BAC in 525 cases (ANNEX TABLE 17. RELATIONSHIP OF BAC IN HYDROMINERAL FOUNTAINS IN BRAZIL).

Since many of the chronic diseases can be treated with the help of these components, problems of nutritional deficiencies can be mitigated by the same, sustainable developments health tourism can be encouraged by the knowledge of their potential uses and debates on classifications of mineral waters can be your bioactivity; It is expected that arouse attention for research and applications of hydromineral fountains in the country in health and welfare benefits.

Through the National Policy of Integrative and complementary Practices in the SUS (PNPIC-SUS), the municipalities with the largest number of BAC can be worth deploying pilot projects for pharmacokinetic studies, pharmacodynamic and clinical trials related to the practice of social thermalism or crenotherapy. And besides the rheumatologic treatments, which are their main indications worldwide, also it is recommended to search the most common applications related to our most common waters oligominerais (kidney problems), radioactive (respiratory, circulatory and nervous system) and silicate (musculo-skeletal and dermatological treatments).But one of the 525 approved health sources of SPRINGS BRAZIL, according to minimum levels of potential BAC, also fit the following crenotherapy ratings:

BAC	SYMBOL	N	VALUE
Carbonated	CO_2	**34**	CO_2>200mg/L
Sulphuric	H_2S	**66**	H_2S>1
Siliceous	Si	**39**	Si>45,1
Chloridated	Cl	**28**	Cl>500
Bicarbonated	HCO_3	**21**	HCO_3>600
Sulphated	SO_4	**50**	SO_4>100
Magnesium	Mg	**24**	Mg>50
Calcium	Ca	**27**	Ca>150
Sodium Diet	Low Na	**231**	Na<20 e STD<1000
Bromidated	Br	**9**	Br>25
Ferruginous	Fe	**10**	Fe>5
Radioactive	Rn	**116**	Rn>134,2 Bq/l
Alkaline - pH	ANTIOX	**50**	pH>9,0
Oligomineral	OLIGO	**290**	STD<300
Isothermal	ISTM	**125**	$^{°C}$>33

N = Number of occurrences

In the face of this apparent hydrodiversity, expected to contribute also in the increase of mineral research options for focusing on water use for bathing, which today constitutes only 13.5% of the total and half of them concentrated in the State of Goiás. As well as on diversification of health rankings, if only for opportunism, are largely hypothermal "at source" or fluoridated water.

And with the information acquired during this work, some final suggestions seek to contribute to the continuity and improvement of the research in this theme, being: systematization of this inventory, increasing these health sources; consider regional and local environmental parameters in the descriptionsin; comparative studies of bioactivities or therapeutic applications; always relieve the Brazilian climatic particularities (tropical wet); studies in thalasotherapy enlarge tropical; assess the gases from the sources and their streams effect and; improve analysis of dissolved substances in colloidal, organic elements, iodine and different forms of iron, silicon and sulfur; increase the accuracy limits of quantification of the analytical methods of trace elements and ultra strokes, due to its importance and abundance in the waters of the country; to conduct research on potential ionizing radiation, hororradioatividades and biological effects of radionuclides; immerse pH basic bioactivities studies, silicon and trace elements in crenoterapy, balneoterapy and nutrition.

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ANNEX

I – GLOSSARY

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II – ANNEX TABLES

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III - ANNEX MAPS AND DIAGRAMS

1. POL REGIONAL AUTOMATIC POINTS SPRINGS BRAZIL GEOREFERENCED.AUTOMATIC
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9. PIPER DIAGRAMS AND DUROV (1, 2, 3 AND 4).

Map 6. Georeferenced Cities with Hydromineral Fountain

SPRINGS BRASIL database

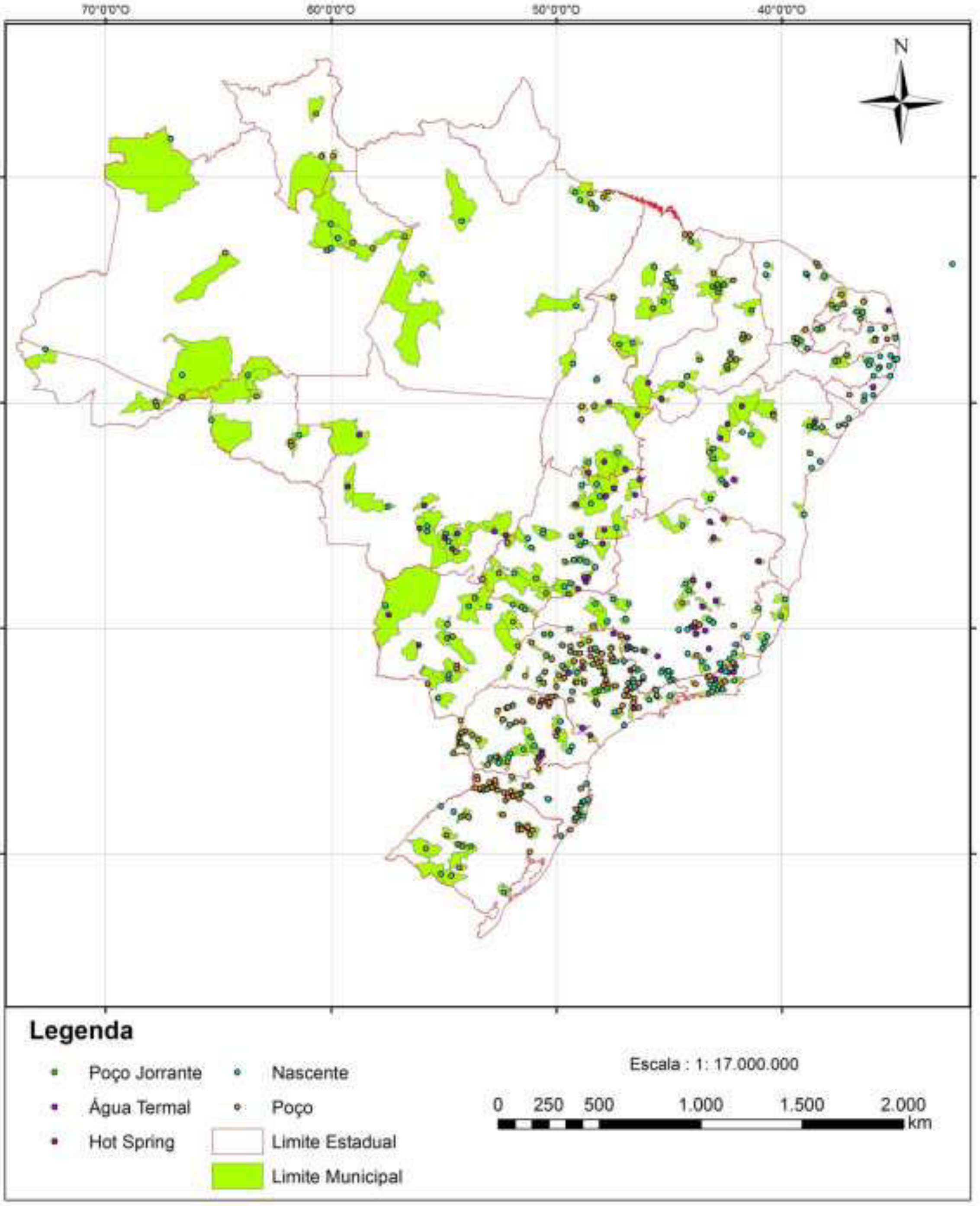


TABLE 5. 60 BAC related symbols

#	*BAC**	SYMBOL	UNITY
1	HYDROMINERAL OFFICIAL RANCH	**a**	Thermalism History+Legal Recognition
2	OWNING AQUATIC SPA TOURISM	**b**	Aquatic Park, SPA / Health Resort
3	BOTTLED WATER	**c**	Industry and Diet Marketing
4	POTENTIAL NATURAL ENDOWNMENT	**d**	Suitable Natural Environment/Resource
5	HOT WATER NAMED PLACE	**e**	Popular Named
6	MOUNTAIN	**MONT**	Meter > Sea
7	HIGH ALTITUDE	**ALT**	Meter > Sea
8	SEASHORE	**TALASSO**	Meter = Sea + Beach
9	LOWER INLAND EXTREME WEATHER	**EQUAT/SAV/ARID**	Meter>Sea +/-Relative Humidity (UTC)
10	TROPICAL ELEVATION ANOMALY	**TROPICSHOK**	Meter > Sea + < Latitude
11	ALTITUDE IN TEMPERATE ZONE	**CAPRICOLD**	Meter > Sea + > Latitude
12	RADON EMANATION	^{222}**Rngas**	Becquerel per Liter (Bq/l)
13	THORON	^{220}**Rn**	Becquerel per Liter (Bq/l)
14	DISCHARGE BULK	**flow**	Liter per Hour (l/h)
15	HORORRADIOACTIVITY	**HORO**	Becquerel per Second (Bq/sec)
16	CALORIC ANIMATION	**hot spring**	Tonne Joule per Year (TJ/y)
17	GEOTERMAL POTENTIAL	**geot**	Centigrade Grade ($^{\circ C}$)
18	HYPERTHERMAL	**HIPT**	Centigrade Grade ($^{\circ C}$)
19	ISOTHERMAL (MESO)	**ISTM**	Centigrade Grade ($^{\circ C}$)
20	HYPOTHERMAL - HOT	**term**	Centigrade Grade ($^{\circ C}$)
21	TEPID	**warm**	Centigrade Grade ($^{\circ C}$)
22	COOL	**cold**	Centigrade Grade ($^{\circ C}$)
23	ANTIOXIDATIVE	**ANTIOX**	pH
24	ALKALINE	**ALK**	pH
25	LIGHTLY ALKALINE	**alk**	pH
26	NEUTRAL	**N**	pH
27	ACID	**ac**	pH
28	RADON	^{222}**Rn**	Becquerel per Liter (Bq/l)
29	HYDROGEN SULFIDE	H_2S	Milligram per Liter (mg/l)
30	CARBON DIOXIDE	CO_2	Milligram per Liter (mg/l)
31	OXYGEN	O_2	Milligram per Liter (mg/l)
32	TDS Faintest	**diet**	Milligram per Liter (mg/l)
33	TDS Oligomineral	**OLIG**	Milligram per Liter (mg/l)
34	TDS Medium Mineralized	**MEIO**	Milligram per Liter (mg/l)
35	TDS Mineral	**STD**	Milligram per Liter (mg/l)
36	TDS Isotonic	**ISTN**	Milligram per Liter (mg/l)
37	TDS Hypertonic	**TALS**	Milligram per Liter (mg/l)
38	HARDNESS	**Dur**	Milligram per Liter (mg/l)
39	SILICON	**Si**	Milligram per Liter (mg/l)

40	CHLORIDE	Cl^-	Milligram per Liter (mg/l)
41	BICARBONATE	HCO_3^-	Milligram per Liter (mg/l)
42	SULFATE	SO_4^{-2}	Milligram per Liter (mg/l)
43	SODIUM	Na^+	Milligram per Liter (mg/l)
44	CALCIUM	Ca^{+2}	Milligram per Liter (mg/l)
45	MAGNESIUM	Mg^{+2}	Milligram per Liter (mg/l)
46	POTASSIUM	K^+	Milligram per Liter (mg/l)
47	ALUMINUM	Al^{+3}	Milligram per Liter (mg/l)
48	BARIUM	Ba^{+2}	Milligram per Liter (mg/l)
49	BORON	B^{-3}	Milligram per Liter (mg/l)
50	BROMINE	Br^-	Milligram per Liter (mg/l)
51	COPPER	Cu^{+2}	Milligram per Liter (mg/l)
52	STRONTIUM	Sr^{+2}	Milligram per Liter (mg/l)
53	TOTAL IRON	Fe	Milligram per Liter (mg/l)
54	FLUORIDE	F^-	Milligram per Liter (mg/l)
55	LITHIUM	Li^+	Milligram per Liter (mg/l)
56	MANGANESE	Mn^{+2}	Milligram per Liter (mg/l)
57	MOLYBDENUM	Mo^{+2}	Milligram per Liter (mg/l)
58	SELENIUM	Se^{+2}	Milligram per Liter (mg/l)
59	VANADIUM	V^{+2}	Milligram per Liter (mg/l)
60	ZINC	Zn^{+2}	Milligram per Liter (mg/l)

TABLE 17. Total BAC obtained by fountain

PT	UF	CITY	WATER FOUNTAIN	CLIMATE	BAC
0	GO	ABADIÂNA	Fazenda Sítio Velho	Aw	222Rngas,d,ISTM,N,diet
1	SP	ÁGUAS DA PRATA	Baln. - Vilella	Cwa	STD,alk,O2+,MHCO3-,BHCO3-,MNa+,BNa+,MCu+2,MSr+2,MF-,MZn+2,BZn+2,warm,CO2,a124,220Rn,222Rn,222Rngas,HORO,DLi+,MMn+2,DMo+2,DV+2,DB-3,ALT
2	SC	ÁGUAS DE CHAPECÓ	Baln. Parque Hidroeste	Cfa	ISTM,MEIO,ALK,a124,MF-,DF-
3	SP	ÁGUAS DE LINDÓIA	Baln./B.Ág.Quente-S.Roque	Cwa	OLIG,warm,N,O2+,a124,220Rn,222Rn,222Rngas,Mflow,HORO,DLi+,DV+2,MZn+2,Al
4	SP	ÁGUAS DE SANTA BÁRBARA	Baln. Sta. Barbara	Cfa	OLIG,term,alk,hot spring,O2+,DSi,a14,222Rngas,HORO,DLi+,DMo+2,DV+2
5	SP	AGUAS DE SÃO PEDRO	Baln.- Juventude	Cwa	STD,term,ANTIOX,BDUR,H2S,DSi,MCl-,a124,220Rn,222RnM,222Rngas,BHCO3-,MNa+,BNa+,DCa+2,DBa+2,MB-3,BB-3,MBr-,HORO,MSr+2,DSr+2,DFe,BF-,MF-,MLi+,BLi+,DLi+,MMn+2,DMn+2,MZn+2,BZn+2,DZn+2
6	MG	AGUAS FORMOSAS	Cór./Ria./B. Água Quente	Cwa-Aw	e,warm
7	SC	AGUAS MORNAS	Baln.Hotel Águas warms	Cfa	ISTM,OLIG,N,a2,222Rn,hot spring,222Rngas,Mflow,HORO,DSi,MB-3,BB-3,DB-3,MF-,DF-,DLi+,MMn+2
8	MG	ALÉM PARAIBA	Nascente	Cw-Cfa	ISTM,d
9	ES	ALFREDO CHAVES	Dupote	Aw-Cwa	TALASSO,term,diet,N,DSi,c,DAl,DF
10	PR	ALMIRANTE TAMANDARÉ	Tranqueira Fervedor	Cfb	OLIG,ALK,cold,BDUR,c,222Rngas,DCa+2,DMg+2,CAPRICOLD,MHCO3-
11	RO	ALTO PARAISO	Água Viva-Linha C-95	Am AMAZON	term,diet,ac,c,DNa+
12	GO	ALTO PARAÍSO DE GOIÁS	Pousada Éden Ág.Termais	Aw	ISTM,OLIG,N,hot spring,d,222Rngas,222RnM,Mflow,HORO,TROPICSHOK
13	MA	ALTO PARNAIBA	Gleba Água Quente	Aw' AMAZON	e,warm
14	PI	ALVORADA DA GURGUÉIA	Chafariz Violeta	Aw' NE	H2S,term,d,Mflow
15	SP	AMPARO	Baln.- Bocaina	Cwa	OLIG,warm,ac,O2+,a1,220Rn,222Rn,222Rngas,DSr+2,DLi+,DMo+2,DV+2,MZn+2,DZn+2
16	SP	ANHEMBI	ASP-Água Cosmética	Cw-Cfa	STD,term,ALK,H2S,BCl-,c,BHCO3-,MSO4-2,BSO4-2,MNa+,BNa+,MB-3,BB-3,MBr-,MSr+2,BF-,MF-,MLi+,BLi+
17	RS	ANTONIO PRADO	Est.Hidrom.-S. Roque	Cfb	OLIG,cold,alk,DSi,a2,DV+2,DLi+,DF-
18	SP	APIAÍ	Riacho Água Quente	Am ATLANT-Cfb	CAPRICOLD,warm,e
19	RN	APODI	Poço 01-Faz.S. Francisco	BS	EQUAT/SAV/ARID,ISTM,OLIG,N,DSi,c,DF-
20	GO	APORÉ	Rio Aporé	Aw	ISTM,d
21	CE	AQUIRAZ	Japão	Aw' LITO	TALASSO,term,OLIG,ALK,DSi,d
22	SP	ARAÇATUBA	Termas Noroeste Baln	Aw	HIPT,OLIG,ANTIOX,DSi,d,Mflow,MF-,DF-,DB-3,DHCO3-
23	GO	ARAGARÇAS	Nascente	Aw	e,term
24	PR	ARAPOTI	Ponte Sulf. Lambedor	Cf-Cfb	CAPRICOLD,cold,OLIG,ANTIOX,H2S,DSi,d,MF-,DF-,MLi+,BLi+,DLi+
25	SC	ARARANGUÁ	Baln. Morro dos Conventos	Cf-Cfb	ISTM,d
26	MG	ARAXÁ	Baln. Hotel - Beja	Aw	ANTIOX,term,STD,H2S,O2+,BSi,DSi,a124,220Rn,222Rn,222Rngas,MHCO3-,BHCO3-,MNa+,BNa+,BK+,MK+,DBa+2,Mflow,HORO,MF-,MLi+,MFe,MSO4-2
27	SC	ARMAZEM	Ág. Term. Sta Terezinha	Cf-Cfb	ISTM,OLIG,N,hot spring,DSi,b,222RnM,222Rngas,HORO
28	TO	ARRAIAS	Faz. Águas warms	Aw	TROPICSHOK,warm,e
29	SP	ATIBAIA	Est.Hidrom./Baln.-Rosário	Cf-Cwa	OLIG,warm,alk,DSi,a4,222Rn,DSr+2,DMo+2,DV+2,MZn+2,BZn+2,DZn+2,DAl3+
30	MG	AUGUSTO DE LIMA	ResortÁg.QuentesStaBárbara	Cw-Cwa	OLIG,term,ALK,BDUR,d,DCa+2,DMg+2,DF-
31	PR	BANDEIRANTES	Baln. Yara-S. Domingos	Cf-Cfa	MEIO,term,ANTIOX,H2S,DSi,d,DSO4-2,DAl+3,BF-,MF-
32	MG	BARBACENA	Sítio das Bicas	Cw-Cwb	222Rn,ac,ALT,c,diet
33	CE	BARBALHA	Baln.Caldas Barbalha	Aw' NE	TROPICSHOK,term,diet,ac,BDUR,hot spring,a3,BHCO3-,DHCO3-,DCa+2,DMg+2,Mflow,Dfe
34	PE	BARRA DE GUABIRABA	Engenho Conceição	Cs	term,diet,ac,hot spring,c,222Rn,DBr-,DF-
35	MA	BARRA DO CORDA	Baln.Guajajara-L.dos Cocos	Aw' AMAZON	STD,warm,ALK,MDUR,MCl-,d,MMg+2,BK+
36	MT	BARRA DO GARÇAS	Baln.Pqe/Cor./Faz.Ág.Quente	Aw	HIPT,OLIG,N,hot spring,d,220Rn,222Rngas,Mflow,HORO,BMn+2,MMn+2
37	RJ	BARRA DO PIRAÍ	Aldeias Aguas Pqe Resort	Cw-Cfa	OLIG,warm,alk,DSi,d,DDUR,DF-
38	SP	BARRA DO TURVO	Córrego Água Quente	Cf-Cfb	e,warm
39	PE	BARREIROS	Nova Aurora	Am ATLANT	TALASSO,warm,OLIG,ac,c,222RnM,DF-,DAl3+
40	SP	BARRETOS	Barretos Thermas Park	Aw	HIPT,OLIG,ANTIOX,DSi,d,DF-
41	SP	BATATAIS	Poço	Cf-Cwa	OLIG,term,N,DSi,DSr+2,O2+
42	CE	BATURITÉ	Baln. Palma	As'	MEIO,warm,N,c,CO2
43	SP	BEBEDOURO	Parque Temático	Aw-Cwa	HIPT,d
44	CE	BEBERIBE	Praia das Fontes	Aw' LITO	TALASSO,warm,d
45	MG	BELO HORIZONTE	Rua Serra Água Quente e Serra do Barreiro	Cw-Cwb	OLIG,warm,N,e,DBa+2
46	PA	BENEVIDES	Iara 1	Af AMAZON	EQUAT/SAV/ARID,ISTM,term,diet,ac,c
47	RN	BODÓ	Dique 4 - Pico Cabugi	As'	warm,H2S,e
48	SP	BOFETE	Faz. N.S. Aparecida	Cf-Cfa	ISTM,STD,ALK,d,222RnM,H2S,MSO4-2
49	GO	BOM JARDIM	Poço Termal	Aw	HIPT,e
50	PI	BOM JESUS	Chafariz-Jorrante	Aw' NE	warm,d,Mflow
51	MS	BONITO	Baln.-Rio de Águas warms	Aw-Cfa	warm,b,Mflow
52	MG	BORDA DA MATA	Cór. da Água Quente	Cw-Cwa	warm,e
53	SP	BOTUCATU	Piapara	Cf-Cfa	term,diet,ac,H2S,d,MCu+2,MZn+2,BZn+2,DZn+2,O2+,CO2

54	MG	BRÁS PIRES	Cór. da Água Quente	Cw-Cwb	warm,e
55	DF	BRASÍLIA	Faz./Setor Hab. Água Quente	Aw	ALT,warm,e
56	PE	BREJO DA MADRE DE DEUS	Estância Faz. Nova, Baln Conceição	Aw' NE	STD,term,alk,BSi,BCl-,b,MHCO3-,BHCO3-,MNa+,BNa+,MCa+2,MMg+2,BMg+2,BK+,MK+
57	CE	BREJO SANTO	Balneario Brejo Santo	Aw' NE	STD,warm,N,b,CO2
58	SC	BRUSQUE	Mineral Agua Park-Nobre	Cf-Cfa	OLIG,warm,ALK ,c,222Rn,DSr+2,DV+2
59	MG	BUENO BRANDÃO	Bom Jesus e Pres. Vargas	Cw-Cwa	ALT,MEIO,warm,alk,DDUR,H2S,b,DNa+,MBa+2,MF-,DFe
60	MG	BUENOPOLIS	Parque Nasc. Águas Quentes Curimataí	Cw-Cwa	term,diet,ac,d
61	GO	BURITI ALEGRE	Lagoa de Água Quente	Cw	warm,d
62	PA	CACHOEIRA DO ARARI	Ilha de Marajó	Af AMAZON	EQUAT/SAV/ARID,term,MEIO,N,MDUR,d,DCa+2,MMg+2,DMg+2,BK+,DK+,BSi,MHCO3-,BHCO3-,DHCO3-
63	GO	CACHOEIRA DOURADA	Baln. Iate Termas Clube	Aw	ISTM,ISTN,alk,MDUR,BCl-,b,BHCO3-,MSO4-2,BSO4-2,MNa+,BNa+,MCa+2,MSr+2,BSr+2,MF-,MLi+,BLi+,H2S
64	RJ	CACHOEIRAS DE MACACU	Wasser Fall	Aw-Cfa	OLIG,term,alk,DSi,d,222Rn,DCa+2,MSr+2,DSr+2
65	RO	CACOAL	Cacoal	Am AMAZON	OLIG,term,N,BDUR,hot spring,DSi,c,BHCO3-,DCa+2,MMn+2,DMn+2
66	MG	CAETÉ	Serra da Piedade	Cw-Cwb	ISTM,STD,N,MDUR,MCl-,c,MCa+2,BCa+2,BK+,MBa+2
67	BA	CAETITÉ	Nascente Água Quente	Aw	TROPICSHOK,warm,e,222Rn
68	SP	CAFELÂNDIA	Paulista	Aw	OLIG,term,ac,a2,DBa+2,DF-,MNO3
69	SC	CAIBI	Parque da Água Mineral	Cf-Cfa	STD,term,ALK,DDUR,d,MNa+,BNa+,MF-
70	MG	CALDAS	Baln-Poçinhos Rio Verde	Cw-Cwa	ALT,MEIO,warm,ANTIOX,DDUR,CO2,DSi,a124,222Rn,DNa+,DMg+2,MBa+2,DBa+2,DFe,MLi+,DLi+,MSO4,H2S
71	GO	CALDAS DE PIRAPITINGA	Lagoa Pirapitinga-P. do Ovo	Aw	HIPT,OLIG,alk,hot spring,DSi,a12,DCa+2,MAl+3,Mflow,MFe,Bfe
72	GO	CALDAS NOVAS	Lagoa de Água Quente	Cw	HIPT,OLIG,alk,hot spring,DSi,a124,222Rn,222Rngas,DAl+3,Mflow,HORO,DDUR
73	PR	CAMBARÁ	P01	CF-CFa	OLIG,term,alk,BDUR,O2+,BSi,BHCO3-,DNa+,DCa+2,DSr+2
74	MG	CAMBUQUIRA	Baln. Marimbeiro 01	Cw-Cwa	OLIG,warm,N,BDUR,CO2,DSi,a124,220Rn,222Rngas,222RnM,DCa+2,DAl+3,MFe ,BFe,DFe,MMn+2
75	BA	CAMPO FORMOSO	Antonica - Toca	Aw' NE	TROPICSHOK,warm,STD,alk,d,CO2,espeleoclimatismo
76	MS	CAMPO GRANDE	CGR160	Aw	ISTM,OLIG,N,hot spring,DSi,c
77	PR	CAMPO LARGO	Pque. Ouro Fino	Cf-Cfb	CAPRICOLD,OLIG,warm,alk,BDUR,O2+,c,222Rngas,DCa+2,Mflow,HORO,DHCO3-
78	PI	CAMPO MAIOR	Fazenda Abelheirinha	Aw' NE	ISTM,N,c
79	MT	CAMPOS DE JULIO	Termal Água Quente	Aw	TROPICSHOK,warm,e
80	SP	CAMPOS DO JORDÃO	Água Santa	Cw-Cfa	MONT,OLIG,warm,ac,O2+,a4,220Rn,222RnM,222Rngas,DMg+2,MB-3,DB-3,MCu+2,Mflow,HORO,MF-,DF-,DLi+,MZn+2,BZn+2,DZn+2
81	SC	CAMPOS NOVOS	Termas Leonense	Cf-Cfb	ISTM,OLIG,N,H2S,d,Mflow
82	SP	CAMPOS NOVOS PAULISTA	Carbog. S. João Batista	Aw-Cfa	diet,ac,CO2,DSi,c,CO2
83	PR	CANDIDO DE ABREU	Baln. Col. Teresa Cristina	Cf-Cfb	term,H2S,d
84	PR	CANDÓI	N.S. de Lourdes	Cf-Cfb	CAPRICOLD,term,OLIG,ANTIOX,H2S,DSi,a3,222RnM,MAl+3,BFe,Dfe
85	RJ	CANTAGALO	Serra/Cór./Faz. Água Quente	Cf-Cfa	MEIO,warm,ALK,BDUR,DSi,c,BHCO3-,DHCO3-,DNa+,DCa+2,DSr+2,DLi+,DF-
86	MG	CARANGOLA	Fervedouro Sta Barbara	Cw-Cwb	STD,term,alk,hot spring,CO2,H2S,a34,222Rn,Mflow,DFe,DHCO3,DF-
87	RN	CARAÚBAS	Baln. Olho D'água do Milho	Aw' NE	ISTM,MEIO,alk,BDUR,MCl-,b,222Rn,DCa+2,DMg+2,DK+,DSO4-2
88	MG	CARMO DO RIO CLARO	Sítio Água Quente	Cw-Cwa	warm,e
89	MA	CAROLINA	Cachoeira Águas warms, Baln. Lajes	Aw	ISTM,e,Mflow
90	PE	CARUARÚ	Vitalino	As	OLIG,warm,N,DSi,c,222Rn,MNa+,BK+,DBr-
91	PR	CASCAVEL	Termas de Cascavel	Cf-Cfa	CAPRICOLD,warm,OLIG,ANTIOX,d
92	PR	CASTRO	Termas Riviera	AmAtlant-Cfb	CAPRICOLD,OLIG,term,alk,DSi,d,222RnM,DFe
93	MG	CATAS ALTAS	Morro/Dist. da Água Quente	Cw-Cwb	warm,e
94	RS	CATUÍPE	Baln. Terra das Ág. Minerais	Cf-Cfa	MEIO,warm,ANTIOX,DSi,a4,DSO4-2,DB-3,DBr-,BF-,MF-,DF-,DLi+,MV+2,DV+2,DHCO3-
95	GO	CAVALCANTE	Vila Água Quente e Poço Escalda	Aw	TROPICSHOK,term,H2S,e
96	MG	CAXAMBÚ	Baln. Mayrink 01	Cw-Cwa	OLIG,warm,N,BDUR,CO2,DSi,a124,222Rn,DHCO3-,BHCO3-,MCa+2,DCa+2,MMg+2,DMg+2,BK+,MK+,DK+,MAl+3,DAl+3,MBa+2,DBa+2,MSr+2,DSr+2,MFe,BFe,DFe,BF-,MF-,DF-,MLi+,DLi+,MMn+2,DMn+2,MZn+2,BZn+2,DZn+2
97	MA	CAXIAS	Baln. e Chafariz Veneza	Aw' NE	TALASSO,MEIO,term,N,H2S,d,MAl+3,Mflow,MFe,BFe,Dfe,DF-,lama
98	MT	CHAPADA DOS GUIMARÃES	Bica das Moças	Aw	TROPICSHOK,HIPT,diet,ac,hot spring,d
99	SC	CHAPECÓ	Baln. - Taquaruçú	Cf-Cfa	ISTM,MEIO,alk,H2S,DSi,d,222Rn,BHCO3-,DHCO3-,Dfe
100	SP	CHARQUEADA	Bairro Paraisolândia	Cw-Cwa	warm,H2S,d
101	PR	CHOPINZINHO	Poço	Cf-Cfb	ISTM,OLIG,ANTIOX,DSi,d,BHCO3-,MF-,DF-
102	PR	CIANORTE	Poço	Cf-Cfa	STD,geot,ALK,BHCO3-,MSO4-2,BSO4-2,MNa+,MF-,DFe
103	BA	CIPÓ	Baln. Genésio Salles	As'	ISTM,STD,alk,MDUR,hot spring,BCl-,MCl-,a14,222Rn,222Rngas,HORO,MCa+2,BCa+2,MMg+2,BK+,MAl+3,MBa+2,MB-3,MBr-,Mflow,HORO,MSr+2,BSr+2,BFe,MLi+,BLi+,BMn+2,MMn+2
104	MA	COELHO NETO	Chafariz Quiabos	Aw' NE	TALASSO,STD,ALK,MDUR,MCl-,d,DSO4-2,MCa+2,DCa+2,MMg+2,DMg+2
105	GO	COLINAS DO SUL	Pousada Éden Termal	Aw	term,d
106	MG	CONCEIÇÃO DAS ALAGOAS	Ubatã Termas Pqe/H.	Aw-Cwa	ISTM,OLIG,ALK,d,MZn+2,DAl3+
107	PA	CONCEIÇÃO DO ARAGUAIA	Baln. Araguaia	Aw	STD,warm,N,e,CO2
108	MG	CONCEIÇÃO DO MATO DENTRO	Baln. Pisc.Nat. Ág.Quente	Cw-Cwb	warm,e
109	MG	CONCEIÇÃO DO RIO VERDE	Contendas Magnesiana	Cf-Cwa	OLIG,warm,ac,BDUR,CO2,BSi,b,222RnM,MFe,BFe,DLi+,MMn+2,DMn+2,MZn+2,BZn+2,DZn+2,DHCO3-

110	TO	CONCEIÇÃO DO TocaNTINS	Baln. Conceição	Aw	STD,warm,N,H2S,e
111	SC	CONCORDIA	Sadia	Cf-Cfa	MEIO,term,ALK,DSi,BHCO3-,MF-
112	BA	CORAÇÃO DE MARIA	San Juliano	Af ATLANT	STD,term,alk,d,222Rn
113	MS	CORGUINHO	COR001	Aw	OLIG,term,N,Dsi
114	PR	CORNELIO PRocoPIO	CCSI-P01	Aw-Cfa	HIPT,OLIG,ANTIOX,BSi,222RnM,MF-,DF-
115	SC	CORONEL FREITAS	1159	Cf-Cfb	MEIO,warm,ALK,BSi,MF-,DF-
116	PR	CORONEL VIVIDA	Ág.do paulino-Sta Rosa	Cf-Cfb	CAPRICOLD,term,OLIG,ANTIOX,H2S,DSi,d,MF-,DF-,DFe
117	SC	CORREIA PINTO	Nascente Sulfurosa	Cf-Cfb	CAPRICOLD,warm,H2S,e
118	MS	COSTA RICA	Ferv.Ág. Sta do Paraiso	Cf-Cfa	Mflow,warm,e
119	RS	COTIPORÃ	Poços Termais	Cf-Cfb	warm,e
120	CE	CRATO	Baln. Cascata e Nascente	Aw' NE	warm,e
121	PI	CRISTINO CASTRO	Chafariz Gurguéia	Aw' NE	Mflow,warm,d
122	AC	CRUZEIRO DO SUL	Moa-Bur.Centr./Cach.Enxofre	Am AMAZON	warm,H2S,d
123	MT	CUIABÁ	Baln. Ág.Quentes-S. Vicente	Aw	HIPT,diet,N,hot spring,b,Mflow
124	SP	CUNHA	Ág.Virtuosas Sta Rosa	Cw-Cfa	OLIG,warm,alk,DSi,b,222Rn,222Rngas,Mflow,HORO
125	RN	CURRAIS NOVOS	Trongola	Bw	MEIO,warm,ALK,BDUR,H2S,e,BHCO3-,DHCO3-,DMg+2
126	MG	CURVELO	Poço Azul	Aw-Cwb	N,BDUR,BSi,d,MHCO3-,BHCO3-,MCa+2,DMg+2,BK+,MK+,DK+,MAl+3,MMn+2,CO2
127	PE	CUSTÓDIA	Sabá	Aw' NE	OLIG,term,N,DSi,b,DFe
128	MG	DELFINÓPOLIS	Cór./P./Cach. Ág.Quente	Cw-Cwa	warm,e
129	BA	DIAS D'ÁVILA	Baln. Saúde	Af ATLANT	TALASSO,Mflow,term,diet,N,hot spring,a3
130	MT	DOM AQUINO	Regidreia	Aw	term,diet,ac,hot spring,DSi,c,DBr-,Mflow
131	PI	DOM EXPEDITO LOPES	Baln. Manaíra	BS	warm,d
132	ES	DOMINGOS MARTINS	Ingá	Aw-Cwa	warm,diet,ac,c,222RnM
133	RS	DOM PEDRITO	Santa Manuela	Cf-Cfb	STD,warm,alk,MDUR,d,MCl-,BHCO3-,MSO4-2,BSO4-2,BFe,MF-,DMg2+,DCa2+
134	MS	DOURADOS	DOU021	Am PANT	ISTM,OLIG,alk,O2+,DSr+2,DZn2+,DNa+
135	PR	DOUTOR CAMARGO	Sítio Primavera	Cf-Cfa	OLIG,warm,alk,BDUR,DSi,c,DCa+2,DSr+2
136	PB	DUAS ESTRADAS	Chafariz Mascate	Aw' LITO	STD,warm,alk,BCl-,d,MNa+,MMg+2
137	PI	ELISEU MARTINS	Jorrante Rio Gurguéia	BS	Mflow,d
138	RS	ENTRE-IJUÍS	Baln.Pqe. das Fontes	Cf-Cfa	term,d
139	PR	ENTRE RIOS DO OESTE	Entre Rios	Cf-Cfa	OLIG,warm,ANTIOX,BSi,d,Dfe
140	RS	ERECHIM	Baln. Cascata Nazzari	Cf-Cfa	CAPRICOLD,HIPT,STD,ALK,d,BHCO3-,MNa+,BF-,MF-,DSO4-2,DAl3+
141	BA	ÉRICO CARDOSO	Cidade Água Quente	BS	TROPICSHOK,ISTM,OLIG,N,BDUR,hot spring,e,DNa+,DMg+2,Mflow
142	PE	ESCADA	Alegria	Cs	OLIG,term,ac,DSi,c,222Rn
143	MA	ESPERANTINOPOLIS	Chafariz Bom Principio	Aw' AMAZON	EQUAT/SAV/ARID,MEIO,ALK,MDUR,d,DSO4-2,MCa+2,DCa+2,DMg+2,BK+
144	MG	FELÍCIO DOS SANTOS	Fontes e Cachoeira Água Quente	Cw-Cwa	OLIG,term,ALK,CO2,DSi d,DCa+2,DAl+3,DBa+2,DLi+,MMn+2,DMn+2
145	PE	FERNANDO DE NORONHA	CasadeBanho-Bica Cachorro	Atlântico	TALASSO,ISTM,STD,ALK,d,MCl-
146	SP	FERNANDÓPOLIS	Termas Agua Viva	Aw	MEIO,geot,ALK,O2+,a2,222RnM,Mflow,MF-,MAl3+,BSi
147	RS	FLORES DA CUNHA	Poço	Cf-Cfb	CAPRICOLD,OLIG,alk,DSi,d,222Rn
148	GO	FORMOSA	Nascente Sulfurosa	Aw	TROPICSHOK,warm,H2S,e
149	GO	FORMOSO	Indaiá	Aw	ISTM,MEIO,alk,DSi,c,BHCO3-,DNa+,DCa+2,DMg+2
150	CE	FORTALEZA	Carbogasosa Acapulco	Aw' LITO	TALASSO,term,OLIG,ac,CO2,DSi,c,MBa+2,DBr-,DSr+2,DLi+
151	MG	FORTALEZA DE MINAS	Água Azul	Cw-Cwa	OLIG,term,alk,hot spring,d,222Rn,Mflow
152	PR	FOZ DO IGUAÇÚ	Mabú Thermas Resort	Cf-Cfa	HIPT,STD,ALK,DDUR,MCl-,a2,BHCO3-,MSO4-2,BSO4-2,MNa+,Mflow,BF-,MF-,DAl3+
153	PR	FOZ DO JORDÃO	Boa Vista	Cf-Cfb	CAPRICOLD,term,MEIO,ANTIOX,H2S,DSi,e,222Rn,BHCO3-,MAl+3,Dfe
154	PR	FRANCISCO BELTRÃO	Termas do Sudoeste	Cf-Cfa	CAPRICOLD,HIPT,OLIG,ANTIOX,BSi,d,DK+,DAl3+,DFe
155	SP	GARÇA	São José	Aw	warm,diet,alk,d,222Rn,DLi+,MMn+2,DMo+2,DV+2,DB-3
156	MT	GENERAL CARNEIRO	Fazenda Águas Quentes	Aw	HIPT,hot spring,e,Mflow,term
157	PI	GILBUÉS	Pqe.Nascentes-R.Ág.Quente	Aw' AMAZON	term,e
158	GO	GOIÁS	Baln.Ág.Sta Bárbara	Aw	OLIG,term,N,DSi,a4,222Rn,MAl+3,DAl+3,DLi+
159	GO	GOIATUBA	Nascente Sulfurosa	Aw	H2S,warm,e
160	SC	GRAVATAL	Termas Gravatal	Cf-Cfa	TALASSO,ISTM,OLIG,N,hot spring,a124,222Rn,222Rngas,Mflow,HORO
161	MG	GUANHÃES	Dois Riachos Água Quente	Cw-Cwb	OLIG,term,N,e,222RnM,CO2
162	RJ	GUAPIMIRIM	Dedo de Deus	Af ATLAN-Cfa	TALASSO,term,diet,N,c ,22RnM,DNa+
163	SC	GUARACIABA	Traíra	Cf-Cfa	OLIG,ANTIOX,DSi,c,DV2+
164	CE	GUARAMIRANGA	Indaiá	Aw' LITO	TROPICSHOK,OLIG,warm,alk,BDUR,DSi,c,222Rn,DCa+2,DBr-,DLi+,MMn+2
165	RS	GUARANI DAS MISSÕES	Baln. Tio Érico	Cf-Cfa	d,lama
166	PR	GUARAPUAVA	Est.Hidrom. Sta Clara	Cf-Cfb	OLIG,term,ANTIOX,hot spring,DSi,b,222Rn,MAl+3,BFe,Dfe
167	SP	GUAREÍ	Monte Cristo e Oswaldo Cruz Baln	Aw-Cfa	MEIO,warm,ALK,BDUR,H2S,d,BHCO3-,DHCO3-,DMg+2
168	GO	HIDROLANDIA	São José	Aw	term,diet,ac,d
169	SP	IACANGA	Hotel Estância Quilombo	Aw-Cwa	OLIG,term,ALK,hot spring,DSi,b,MB-3,DB-3,MCu+2,DCu+2,MF-,MSe+2,MZn+2,BZn+2,DZn+2
170	SP	IBIRÁ	Baln. Carlos Gomes	Aw	OLIG,warm,ANTIOX,H2S,O2+,DSi,a124,MB-3,DB-3,MCu+2,DSr+2,DLi+,DMo+2,MV+2,DV+2,MZn+2,BZn+2,DZn+2
171	MG	IBIRACI	Carbogasosa Laje Queiróz	Cw-Cwa	STD,warm,alk,CO2,c,MHCO3-,BHCO3-,MCa+2,BK+,MK+,DMg2+

172	SP	IBITINGA	Cór. e Capela Ág.Quente	Aw-Cwa	ISTM,OLIG,ALK,e,MF-,MZn+2,DZn+2
173	BA	IBITUNANE-GENTIO DO OURO	Riacho Água Quente	As'	TROPICSHOK,warm,e
174	BA	IBOTIRAMA	Princesinha	Aw	OLIG,term,ac,c,222Rn
175	MA	IGARAPÉ GRANDE	Chafariz Caneleiro	Aw' AMAZON	EQUAT/SAV/ARID,STD,alk,MDUR,MCl-,d,MCa+2,BCa+2,MMg+2
176	RS	IJUÍ	Ijuí Baln, Cristalina	Cf-Cfa	MEIO,warm,ANTIOX,DDUR,H2S,DSi,b,DBr-,MF-,DF-,DMn2+,DAl3+
177	SC	IMARUÍ	Mineralli 01 Baln	Cf-Cfb	ISTM,OLIG,ac,hot spring,H2S,DSi,e,222Rn,Mflow,DBr-,DF-
178	MA	IMPERATRIZ	Chafariz Vila Lobão	Aw' AMAZON	MEIO,term,N,BDUR,d,DNa+,DMg+2,DK+
179	RS	IPÊ	Poço CO2	Cf-Cfb	CAPRICOLD,OLIG,N,c,222Rn,MZn+2,DZn+2,CO2
180	RS	IRAÍ	Baln. Água do Mel	Cf-Cfa	220Rn,ISTM,STD,ALK,hot spring,DSi,MCl-,a124,222Rn,222Rngas,DSO4-2,MNa+,MAl+3,HORO,BF-,MF-,H2S
181	PR	IRATI	Rio/B. Ág.Quente Meiras	Cf-Cfb	CAPRICOLD,warm,e
182	BA	IRECÊ	Nascentes Radioativas	Cf	TROPICSHOK,e,222Rn
183	PR	IRETAMA	Baln. Jurema	Cf-Cfb	MEIO,warm,ANTIOX,H2S,DSi,a2,BHCO3-,DHCO3-,MF-,DF-,DLi+,DMo+2,DV+2
184	SC	IRINEÓPOLIS	Est.Hid. Porto União	Cf-Cfb	CAPRICOLD,term,OLIG,ALK,H2S,d
185	SC	ITÁ	Baln. Termas Itá	Cf-Cfa	ISTM,MEIO,ANTIOX,b,BHCO3-,DSO4-2,MB-3,BB-3,DB-3,DBr-,MF-,DF-,MLi+,DLi+,DAl3+
186	MG	ITABIRA	S. Francisco do Giráu	Aw-Cwb	ISTM,diet,ac,DSi,d,222Rn,222Rngas,MAl+3,HORO
187	MG	ITABIRITO	Cór.Ág.Quentes Moeda Baln	Cw-Cwb	ALT,term,OLIG,N,BDUR,hot spring,DSi,d,DNa+,DCa+2,Mflow,DFe,MMn+2,DMg2+,DK+
188	RJ	ITABORAÍ	Carbogasosa Ferma	Aw-Cfa	EQUAT/SAV/ARID,warm,OLIG,N,CO2,DSi,c,222Rn,DCa+2,DMg+2
189	AM	ITACOATIARA	Vila Lindoia	Am AMAZON	EQUAT/SAV/ARID,term,OLIG,ac ,c,DNa+
190	BA	ITAGUAÇÚ DA BAHIA	Riacho Água Quente	As'	warm,e
191	PR	ITAIPULANDIA	Baln. Jacutinga	Cf-Cfa	HIPT,STD,ALK,d,MNa+,BNa+,BFe,BF-,MF-,MSO4-2
192	PA	ITAITUBA	Miritituba	Af AMAZON	EQUAT/SAV/ARID,STD,geot,alk,BDUR,hot spring,H2S,MCl-,d,MMg+2,BMg+2,MAl+3,DAl+3
193	GO	ITAJÁ	IJ1	Aw	OLIG,term,N,a4,Mflow,MZn+2,BZn+2,DZn+2
194	SC	ITAJAÍ	Camburiu	Cf-Cfa	TALASSO,diet,ac,DSi,b,222Rn
195	MG	ITAMONTE	Engenho da Serra	Cw-Cwa	diet,ac,c,222Rn
196	RJ	ITAocaRA	Serra de Agua Quente	Cw-Cwa	MEIO,warm,N,BDUR,e
197	BA	ITAPARICA	Bica Sto Antonio	Am ATLANT	TALASSO,OLIG,term,ac,a34,220Rn,222Rngas,222RnM,MAl+3,DBr-,HORO,DSr+2,MFe,BFe,DFe,MMn+2,DMn+2
198	ES	ITAPEMIRIM	São José do Frade	Aw-Cwa	EQUAT/SAV/ARID,warm,OLIG,alk,c,222RnM,DF-,DNa+
199	RJ	ITAPERUNA	Baln.Pqe. Soledade	Aw-Cwa	OLIG,warm,ac,BDUR,CO2,BSi,a1,222RnM,BHCO3-,DHCO3-,DCa+2,DMg+2,DB-3,DBr-,DSr+2,MFe,BFe,MF-,DF-,DLi+,MMn+2,DMn+2,MZn+2,BZn+2,DZn+2
200	BA	ITAPICURÚ	Baln. Fervente	Aw' NE	ISTM,STD,ALK,MDUR,hot spring,BCl-,b,222Rn,222Rngas,MCa+2,BCa+2,MBa+2,DBa+2,MB-3,BB-3,MBr-,DBr-,Mflow,HORO,MSr+2,BSr+2,DSr+2,MLi+,DLi+,MMn+2
201	SP	ITAPIRA	Cristália	Cw-Cwa	OLIG,warm,N,DSi,c,222Rn,DMo+2,DV+2,MZn+2,BZn+2,DZn+2
202	GO	ITAPIRAPUÃ	Baln. Santo Antonio	Aw	OLIG,term,ALK,H2S,BSi,b,222Rn,MAl+3,DFe,BF-,MF-,DK+
203	SP	ITÁPOLIS	Monjolinho	Aw	OLIG,BSi,term,N,c,DSr+2
204	MS	ITAPORÃ	ITA005	Am PANT	OLIG,warm,N,BSi
205	SP	ITATIBA	Centro	Cf-Cwa	OLIG,warm,N,222RnM
206	MG	ITAÚNA	Est.Hid. Viva	Cw-Cwb	warm,diet,ac,d,222Rn
207	SP	ITIRAPINA	Faz. Ubá	Cf-Cwa	O2+,warm,diet,ac,CO2,MCu+2,MZn+2,DZn+2,CO2
208	ES	IUNA	SantuárioÁgStaPedraPecado	Cw-Cwa	b
209	PE	JABOATÃO	Fazenda Mussaiba	Am ATLANT	TALASSO,term,OLIG,ac,DSi,c,222Rn
210	MT	JACIARA	Cór./Serra Ág.Quente Poúro	Aw	HIPT,warm,OLIG,diet,alk,ac,hot spring,DSi,b,222Rn,Mflow
211	MG	JACUTINGA	Sete de Abril	Cw-Cwa	warm,diet,ac,a4,222Rn
212	SP	JALES	Yara	Aw	HIPT,OLIG,ANTIOX,DSi,d,Mflow,MF-,DF-
213	MG	JANUÁRIA	Faz. Campo do Porco	Aw	ISTM,STD,N,CO2,c,222RnM,MHCO3-,BHCO3-,MCa+2,BK+,MK+,MFe,Bfe
214	AL	ARAPIRACA-JARAMATAIA	Campestre	Aw' LITO	MEIO,term,alk,c,BSi,BHCO3,DHCO3,MMg+2,BMg+2,DMg+2,MB-3,BB-3,DB-3,DBr-,DMo+2,MV+2,DV+2,DSi,DCu2+,DZn2+,DHCO3-,Galio
215	PR	JARDIM ALEGRE	Patrimonio Jardim Florestal	Cf-Cfa	STD,term,ANTIOX,BDUR,MCl-,d,MSO4-2,BSO4-2,MNa+,MCa+2,MF-
216	GO	JATAÍ	Polo Tur. Vale Paraíso	Aw-Cwa	ISTM,OLIG,ANTIOX,hot spring,O2+,DSi,d,222Rn,222Rngas,DAl+3,Mflow,HORO,DLi+,MZn+2,BZn+2,DZn+2
217	TO	JAÚ DO TocaNTINS	Sueste	Aw	HIPT,diet,ac,hot spring,DSi,d,Mflow
218	PI	JOÃO COSTA	CE340	BS	MEIO,alk,BDUR,DSi,d,MSO4-2,DSO4-2,DCa+2,DMg+2,BK+,DK+
219	PI	JOSÉ DE FREITAS	Marcos	Aw' NE	ISTM,alk,d
220	CE	JUAZEIRO DO NORTE	Carbogasosa Pde Cícero	Aw' NE	OLIG,term,ac,CO2,DSi,c
221	MT	JUÍNA	Rio Água Quente	Aw	warm,e
222	MG	JUÍZ DE FORA	Salvaterra - Pedra	Cw-Cwb	222Rngas,warm,diet,alk,e,222RnM,220Rn,DFe,MMn+2
223	MT	JUSCIMEIRA	Baln. Santa Elvira	Aw	HIPT,hot spring,d
224	MS	LADARIO	Sinhasinha	Aw	OLIG,term,N,BDUR,H2S,DSi,e,BHCO3-,DMg+2,DHCO3-
225	GO	LAGOA SANTA	Baln. Termas	Aw	OLIG,term,N,hot spring,DSi,a2,Mflow,HORO,MSr+2,DSr+2,DLi+
226	PB	LAGOA SECA	Sítio Cantagalo	As	TROPICSHOK,MEIO,N,BDUR,BSi,d,DMg+2,Dfe
227	MG	LAMBARI	3	Cw-Cwa	OLIG,warm,ac,CO2,a14,222RnM,DAl+3,BFe,DFe,MLi+,DLi+,MMn+2,MZn+2,BZn+2,DZn+2
228	CE	LAVRAS DA MANGABEIRA	Limoeiro	Aw' NE	MEIO,N,BDUR,c,BHCO3-,DMg+2
229	MG	LEOPOLDINA	Tebana	Cw-Cwb	term,c
230	SP	LINDÓIA	Baln. Maria Bela	Cw-Cwa	OLIG,warm,N,O2+,DSi,a14,222Rn,DFe,MF-,DF-,DLi+,DMo+2,DV+2,MZn+2,BZn+2,DZn+2
231	ES	LINHARES	Carbogasosa Tres Pontas	Aw	EQUAT/SAV/ARID,warm,diet,ac,CO2,c
232	SP	LINS	Baln. Fátima	Aw	HIPT,MEIO,ANTIOX,DSi,d,Mflow,MF-,DF-
233	RS	SANT'ANA DO LIVRAMENTO	Estação Santa Eulália	Cf-Cfa	MEIO,Mdur,d,N,DNa+,DCa+2,DMg+2,DSO4,DK

234	PR	LONDRINA	Baln. Termas Sta Rita	Cf-Cfa	HIPT,OLIG,ANTIOX,DSi,d,222RnM,MF-,DF-
235	GO	LUZIÂNIA	Faz. Água Quente	Aw	term,e
236	RJ	MACAÉ	Andorinha	Cw	OLIG,term,N,DSi,c,222RnM,DBr-
237	BA	MACAÚBAS	Tinguis	Aw	TROPICSHOK,term,e
238	RS	MACHADINHO	Pqe. Aquático Thermas	Cf-Cfa	CAPRICOLD,HIPT,N,a2
239	RJ	MAGÉ	Serra dos Órgãos	Aw-Cfa	EQUAT/SAV/ARID,warm,diet,ac,c
240	SP	MAIRIPORÃ	SPA Unique Garden	Cf-Cfa	CAPRICOLD,cold,OLIG,alk,O2+,DSi,d,222Rn,DLi+,DMo+2,DV+2,DZn+2
241	PR	MALLET	Baln. Dorizzon	Cf-Cfb	CAPRICOLD,warm,OLIG,alk,H2S,DSi,a1,MAl+3,DAl+3,DFe,MF-
242	PR	MANGUEIRINHA	Vigor Baln.	Cf-Cfb	CAPRICOLD,cold,STD,ANTIOX,H2S,DSi,d,BHCO3-,DHCO3-,MF-,DF-,DLi+,DHCO3-
243	PA	MARABÁ	Cristal	Am AMAZON	HIPT,diet,ac,DSi,e
244	RS	MARCELINO RAMOS	Baln. Marcelino Ramos	Cf-Cfa	HIPT,OLIG,alk,H2S,a12,DCa+2
245	PR	MARECHAL CANDIDO RONDON	Coroados	Cf-Cfa	ISTM,STD,ALK,BDUR,MCl-,c,MSO4-2,BSO4-2,MNa+,BNa+,BF-,MF-
246	SP	MARÍLIA	Estância Paraíso	Aw-Cfa	HIPT,MEIO,ANTIOX,BSi,c,BHCO3-,DHCO3-
247	PR	MARINGÁ	Baln.Termas Maringá	Cf-Cfa	HIPT,STD,ALK,d,222RnM,Mflow,MSr+2,BF-,MF-
248	MG	MARIO CAMPOS	Est.Hid. Bom Jardim	Cw-Cwb	OLIG,alk,b,222Rn,Mflow
249	RS	MATA	Jorrantes salinas	Cf-Cfa	diet,e
250	SP	MATÃO	P°Cjor	Aw	OLIG,term,N,O2+,DSi,d,DCa+2,DSr+2
251	TO	MATEIROS	Rio Ág.Quente-Ferv.Jalapão	Aw' AMAZON	warm,d
252	PR	MATELANDIA	P°Cjor	Cf-Cfa	STD,term,ALK,d,MSO4-2,Mflow,MF-
253	GO	MINAÇU	Cristal Azul	Aw	OLIG,term,alk,BDUR,hot spring,e,DCa+2,DMg+2
254	GO	MINEIROS	PD3	Aw-Cwa	OLIG,term,alk
255	CE	MISSÃO VELHA	Sítio Riacho Seco	Aw' NE	geot
256	MG	MONJOLOS	Fazenda Moendas	Cw-Cwa	MEIO,term,ALK,BDUR,d,BHCO3-,DHCO3-,DNa+,MCa+2,DCa+2
257	PA	MONTE ALEGRE	Baln.Menino de Deus(Verê)	Aw' AMAZON	EQUAT/SAV/ARID,ISTM,MEIO,N,H2S,DSi,MCl-,a4,BHCO3-,DHCO3-
258	SP	MONTE ALEGRE DO SUL	Baln.Camanducaia	Aw-Cwa	OLIG,warm,N,a14,222Rn,DSr+2,MF-,DLi+,DMo+2,DV+2,MZn+2,BZn+2,DZn+2
259	SP	MONTE ALTO	Poço MA	Aw-Cwa	ISTM,OLIG,alk,DSr+2,MZn+2
260	MG	MONTE AZUL	Corrego Água Quente	Aw	warm,e
261	MG	MONTE SIÃO	Virtuosa	Cw-Cwa	OLIG,warm,alk,a4,222Rngas,222RnM,HORO
262	PB	MONTEIRO	Alagoa do Monteiro Chaf	BS	TROPICSHOK,term,STD,alk,CO2,d,MCa+2,MMg+2,BMg+2
263	GO	MONTES CLAROS DE GOIAS	Olho D'Água	Aw	Term,diet,ac,hot spring,H2S,e
264	MG	MONTEZUMA	Baln. Areião Águas Quentes	Aw-Cwa	TROPICSHOK,HIPT,OLIG ,ALK,hot spring,DSi,d,Mflow,Dfe
265	BA	MORRO DO CHAPEU	Baln. Tareco	Cw	TROPICSHOK,term,ALK,d
266	MA	MORROS	Baln. Una dos Morais	Aw	EQUAT/SAV/ARID,term,OLIG,alk,d
267	RN	MOSSORÓ	Hotel Thermas Mossoró	As'	EQUAT/SAV/ARID,HIPT,MEIO,alk,BDUR,b,BHCO3-,DCa+2,DMg+2,DBr-,MSr+2,DSr+2,DMo+2,DV+2,DK+
268	AL	MURICI	Riacho Água Quente	As'	EQUAT/SAV/ARID,warm,e
269	MS	NHECOLANDIA-CORUMBÁ	Lagoas Salinas	Aw	ISTN,BSi,BCl-,MHCO3-,BHCO3-,term,ANTIOX,d,MNa+,BNa+,BK+,MK+,MBr-,BF-,MF-
270	GO	NIQUELANDIA	Corrego Forquilha	Aw	H2S,e
271	MT	NOBRES	Ág.Quente Bom Jardim	Aw	HIPT,d,DMg+2
272	PR	NOVA AMÉRICA DA COLINA	Rib. Água Quente Baln.	Cf-Cfa	OLIG,term,ANTIOX,H2S,DSi,b,DSr+2,MF-,DMo+2,DV+2
273	RO	NOVACALIFORNIA-PT.VELHO	Nova Califórnia	Am AMAZON	Diet,ac,c,DFe,CO2
274	MG	NOVA ERA	São José	Cw-Cwb	OLIG,warm,N,e,222Rn,MMn+2,DMn+2
275	TO	NOVA FATIMA-FATIMA	GO10	Aw' AMAZON	OLIG,term,alk,DSi,MFe,BFe,DFe,MMn+2,MZn+2
276	RJ	NOVA FRIBURGO	S.José Termas Novas	Cf-Cfa	warm,diet,N,d,222Rn,DV+2
277	MG	NOVA LIMA	Ág.Quente Mutuca	Cw-Cwb	warm,diet,alk,e,MMn+2,MZn+2,BZn+2,Zn+2,DFe
278	RS	NOVA PRATA	Complexo Hid. Sta Barbara	Cf-Cfb	MEIO,term,ALK,H2S,DSi,a2,DSO4-2,DB-3,DBr-,BF-,MF-,DF-,DLi+,MV+2,DV+2
279	PI	NOVA SANTA RITA	Umbuzeiro	Bw	MEIO,N,BDUR,BSi,d,DSO4-2,DCa+2,DMg+2,DFe
280	TO	NOVO ACORDO	Lagoa Termal Sudeste	Aw' AMAZON	Term,diet,N,hot spring,DSi,e,222Rngas,Mflow
281	SP	OLÍMPIA	Baln.Termas Laranjal	Aw	HIPT,OLIG,ANTIOX,DSi,d
282	BA	OLIVEIRA DOS BREJINHOS	De Cristal	Aw	warm,b
283	BA	OLIVENÇA - ILHÉUS	Baln. Toromba	Af ATLANT	TALASSO,warm,a3,222Rn,HORO,DMg+2,DFe,Iodo
284	SC	OURO	Baln. Thermas de Ouro	Cf-Cfa	ISTM,d
285	PI	PAES LANDIM	Baln. Chafariz	BS	Mflow,d
286	PR	PAIÇANDU	Água Boa	Cf-Cfa	OLIG,ALK,DDUR,DSi,c
287	SC	PALHOÇA	Baln. Guarda Cubatão	Cf-Cfb	TALASSO,ISTM,OLIG,ac,hot spring,DSi,a3,220Rn,222Rn,222Rngas,HORO,MF-,DF-
288	MG	PALMA	Três Barras	Cw-Cwb	MEIO,term,N,CO2,c,DNa+,MMn+2
289	PR	PALMAS	Barra do Iratim	Cf-Cfb	ANTIOX,term,c,MCu+2,MFe,BFe,MMn+2,MZn+2,BZn+2,DZn+2
290	BA	PALMAS DE MONTE ALTO	Baln. Serra de Monte Alto	Aw	STD,warm,N,d,CO2
291	SC	PALMITOS	Baln. Ilha Redonda	Cf-Cfa	ISTM,MEIO,ALK,H2S,DSi,a3,222Rn,MSO4-2,DSO4-2,DBr-,DSr+2,MF-,DF-,MLi+,DLi+,Iodo
292	SP	PARAGUAÇÚ PAULISTA	Baln. Termas Araras	Aw-Cfa	HIPT,MEIO,ALK,BSi,DSi,a1,MF-,DF-,MMn+2
293	RJ	PARAÍBA DO SUL	Salutaris	Cw-Cfa	MEIO,warm,N,BDUR,BSi,a1,BHCO3-,DHCO3-,DCa+2,DMg+2,DSr+2,BFe,DFe,DLi+,MMn+2,DMn+2
294	TO	PARAISO DO TocaNTINS	GO16	Aw' AMAZON	HIPT,OLIG,alk,Dsi
295	TO	PARANÃ	Fazenda Caldas	Aw	ISTM,OLIG,N,hot spring,CO2,DSi,d,DCa+2,MMn+2,MZn+2,BZn+2,DZn+2
296	BA	PARATINGA	Baln. Termas do Paulista	BS	term,d,Mflow

297	AM	PARINTINS	Poço raso	Af AMAZON	EQUAT/SAV/ARID,term,OLIG,ac
298	RN	PARNAMIRIM	R.Ág.Quente Pirangi	As	TALASSO,warm,diet,ac,DSi,e,DBa+2
299	MG	PASSA QUATRO	Padre manoel	Cw-Cwa	OLIG,warm,N,CO2,a34,220Rn,222Rn,222Rngas,HORO,DSr+2,DHCO3-
300	RS	PASSO FUNDO	Pqe.Termal Roselandia	Cf-Cfa	HIPT,d
301	PR	PATO BRAGADO	Poço	Cf-Cfa	MEIO,warm,ANTIOX,DSi,MF-,DF-
302	MG	PATR°CÍNIO	Serra de Salitre	Cf-Cwa	STD,warm,ANTIOX,CO2,H2S,BSi,a24,222RnM,BHCO3- ,MNa+,BNa+,BK+,MAl+3
303	MT	PEDRA PRETA	VEM111	Aw	ISTM,OLIG,N,O2
304	SC	PEDRAS GRANDES	Baln.TermasS.PedroUruçun ga	Cf-Cfb	MEIO,term,alk,hot spring,DSi,a4,222Rn,DCa+2,Mflow,BF-,MF-
305	SP	PEDREGULHO	Cór./Baln. Ág.Quentes	Cw-Cwa	term,d,220Rn
306	SP	PEDREIRA	Vô Basilio	Aw-Cwa	OLIG,N,DSi,c,222Rn
307	RN	PEDRO AVELINO	União	BS	MEIO,term,ALK ,BDUR,d,BHCO3-,DCa+2,DMg+2
308	PI	PEDRO LAURENTINO	CE329	BS	MEIO,alk,BDUR,d,DSO4-2,DMg+2,MFe,Bfe
309	GO	PEIXE- MONTIVIDIU DO NORTE	Faz.Ág.Quente-Mata Azul	Aw	term,e,Mflow
310	RS	PELOTAS	Nova Santa	Cf-Cfb	OLIG,cold,alk,d,222Rn
311	SP	PEREIRA BARRETO	FBT001	Aw	HIPT,MEIO,ALK,DSi,BHCO3-,DBa+2,MSr+2,DSr+2,MF-,DF-,MLi+, DLi+
312	SP	PERUÍBE	Baln. Lama	AmATLAN T-Cfa	TALASSO,STD,N,MDUR,H2S,a3
313	RJ	PETRÓPOLIS	Santa Lúcia	As-Cfa	cold,diet,ac,DSi ,b,222Rn
314	PI	PICOS	Junco 1	BS	ISTM,OLIG,ALK,DSi,c,DHCO3
315	SP	PIEDADE	Minabela	Cf-Cfa	CAPRICOLD,term,diet,ac,c,222Rn
316	PR	PIRAÍ DO SUL	Ág.Quente da Fé	Cf-Cfb	CAPRICOLD,term,MEIO,alk,d,222Rn,DFe
317	SP	PIRAJU	SP154	Aw-Cfa	OLIG,term,alk,Bsi
318	SP	PIRAJUÍ	Cór./Bairro Água Quente	Cf	warm,e,Mflow
319	SP	PIRATININGA	Baln. Termas Lais Carlo	Cw-Cfa	HIPT,ISTN,ALK,MDUR,O2+,MCl- ,b,BHCO3-,MSO4-2,BSO4-2,MNa+,BNa+,MCa+2,Mflow,MSr+2,MLi+,BLi+,MMn+2
320	SC	PIRATUBA	Baln. Cia. Hidrotermal	Cf-Cfa	HIPT,MEIO,ALK,DSi,a124,222Rn,BHCO3-,DHCO3- ,DAl+3,MLi+,DLi+,H2S
321	GO	PIRENÓPOLIS	Poço Água Quente	Aw	ISTM,d,Mflow
322	GO	PIRES DO RIO	Nascente	Aw	MEIO,warm,N,e,DMg+2
323	SP	PITANGUEIRAS	Termas Clube	Aw-Cwa	HIPT,OLIG,ALK,d,Mflow ,DSr+2,DLi+
324	SC	PLANALTO ALEGRE	1534	Cf-Cfa	STD,warm,ANTIOX,MDUR,MCa+2,MF-
325	SP	POÁ	Áurea Baln	Cf-Cfa	CAPRICOLD,warm,diet,N,a34,222Rn,DLi+,DMo+2,DV+2,MZn+2,BZn+2, DZn+2
326	MG	POÇOS DE CALDAS	Baln. Pedro Botelho	Cw-Cwa	HIPT,MEIO,ANTIOX,hot spring,CO2,H2S,O2+,DSi,a124,220Rn,222Rngas,222RnM,MAl+3 ,DAl+3,HORO,DFe,BF-,MF-
327	RO	PORTO VELHO	Kaiary	Am AMAZON	MEIO,term,ac,BDUR,c,DSO4-2,DCa+2,DMg+2,Dfe
328	RS	PORTO XAVIER	Tombo de Água	Cf-Cfa	DSO4,BBr,e
329	GO	POSSE	Baln.Rio/Cach. Ág.Quente	Aw	TROPICSHOK,warm,d
330	SP	POTIRENDABA	Poty	Aw	OLIG,term,ANTIOX,DSi,c,MSr+2,DSr+2,DV+2
331	MT	POXORÉO	Fazenda Águas Quentes	Aw	HIPT,hot spring,e
332	MG	PRATÁPOLIS	Vila 3 fontes	Cw-Cwa	H2S,term,d
333	SP	PRESIDENTE EPITÁCIO	Termas Epitácio	Aw	MEIO,geot,ALK,DSi,d,BHCO3-,DHCO3-,Mflow,MSr+2,DSr+2,BF-,MF- ,MLi+,DLi+
334	AM	PRESIDENTE FIGUEIREDO	Sta Claudia Midas	AmAMAZ ON	EQUAT/SAV/ARID,term,diet,ac,hot spring,c,DAl+3,Mflow
335	SP	PRESIDENTE PRUDENTE	Baln. Termas Prudente	Aw-Cfa	MEIO,geot,ALK,DSi,b,MB-3,BB-3,DB-3,DSr+2,DFe,BF-,MF-
336	MS	PRUD. THOMAZ-RIO BRILHANTE	PRT002	Am PANT	ISTM,MEIO,ALK,DSi,MF-,DF-,MZn+2,DZn+2,BHCO3-,DHCO3-
337	PR	PRUDENTÓPOLIS	Termas Sulfurosas São João	Cf-Cfb	CAPRICOLD,HIPT,H2S,d
338	SC	QUILOMBO	Baln. das Águas	Cf-Cfa	ISTM,MEIO,ALK,DSi,b,MF-,DF-,H2S
339	GO	QUIRINOPOLIS	Usina São Francisco	Aw	HIPT,MEIO,ALK
340	PR	REBOUÇAS	Água Quente dos Luz	Cf-Cfb	CAPRICOLD,warm,e
341	MG	RESPLENDOR	Sete Salões	Cw-Cwa	term,diet,ac,c
342	MA	RIACHÃO	Biquinha Fervedouro Estiva	Aw' AMAZON	warm,H2S,d
343	MG	RIACHO DOS MACHADOS	Ribeirão Água Quente	Aw-Cwa	warm,e,Mflow
344	BA	RIBEIRA DO POMBAL	Rio Quente	Aw' NE	warm,e,Mflow
345	PR	RIBEIRÃO DO PINHAL	Poço	Cf-Cfa	OLIG,warm,ac,CO2,O2+
346	PR	RIO AZUL	Faxinal Ág.Quente Meiras	Cf-Cfb	CAPRICOLD,warm,e
347	RJ	RIO BONITO	Pedra Branca	Aw	EQUAT/SAV/ARID,warm,OLIG,ac,DSi,e,222Rn
348	RJ	RIO DE JANEIRO	Água Santa Cruz	Aw-Cfa	222RnM,e,term,N,OLIGO,TALASSO,MMn+2,DMn+2,DF-
349	AM	RIO PRETO DA EVA	Baln. Rio Urubú	Am AMAZON	ac,d,diet,EQUAT/SAV/ARID,term,DMo+2,MZn+2,BZn+2,DZn+2
350	GO	RIO QUENTE	Baln. Resort	Aw-Cwa	222Rngas,222RnM,a12,ac,CO2,HIPER,HOT SPRING,OLIG,DAl+3,Mflow,HORO
351	MT	RONDONÓPOLIS	Comunidade Ág.Quente	Aw	warm,e
352	RO	ROLIM DE MOURA	70	Am AMAZON	MEIO,BDUR,N,DSO4-2,DCa+2,Dfe
353	SE	ROSÁRIO DO CATETE	Baln. Caldas Bamburral	Am ATLANT	b,H2S,term,N,MEIO,TALASSO
354	PE	SALGADINHO	Baln. H. Thermas Salgadinho	As	a3,BCl-,BDUR,HIPER,HOT SPRING,N,O2,STD,MHCO3-,BHCO3- ,MSO4-2,BSO4-2,MNa+,BNa+,MCa+2
355	SE	SALGADO	Baln. Salgado	As'	a1,MEIO,BDUR,term,HOT SPRING,N,DCa+2,DMg+2,Mflow,MCl-

356	PR	SANTA AMELIA	Laranjinha	Cf-Cfa	alk,c,MEIO,warm,BSi,DNa+,DCa+2
357	PA	SANTA CRUZ DO ARARÍ	PE31	Am AMAZON	d,BDUR,EQUAT/SAV/ARID,term,N,Si,STD,MCl-,BHCO3-,MNa+,MMg+2,MFe,BFe
358	PI	SANTA CRUZ DO PIAUÍ	Baln.Curralinho	BS	alk,d,MEIO,BDUR,Mflow,DCl-,DHCO3-,DSO4-2
359	PR	SANTA HELENA	Strassburger	Cf-Cfa	d,N,MF-,MV+2,DV+2,DLi+
360	MG	SANTA LUZIA	Camelo	Cw-Cwb	222Rn,CO2,d,MEIO,H2S,warm,N,MAl+3,DAl+3,DFe
361	MA	SANTA LUZIA	Chafariz Santarem	Aw' AMAZON	alk,d,EQUAT/SAV/ARID,N,MEIO,DK+
362	RO	SANTA LUZIA D'OESTE	73	Am AMAZON	MEIO,N,DNa+,c,DSO4-2
363	RS	SANTA MARIA	Cyrilla e Camobi	Cf-Cfa	222Rn,d,N,STD,MNa+,MF-
364	PB	SANTA RITA	Fazenda Caldeirão	Am ATLANT	ac,c,term,OLIGO,TALASSO,MAl+3,DAl+3
365	MG	SANTA RITA DE MINAS	Santa Rita do Sapucaí	Cw-Cwa	222Rn,d,warm,N,OLIGO,DSr+2
366	SP	SANTA ROSA DE VITERBO	Águas Claras	Cw-Cwa	222Rn,ac,c,diet,term,HOT SPRING
367	SC	SANTA ROSA DE LIMA	Águas warms Sta Rosa	Cf-Cfb	222Rn,b,term,N,OLIGO
368	MG	SANTANA DA VARGEM	Corrego da Água Quente	Cw-Cwb	e,warm
369	RN	SANTANA DO MATOS	Termal Sulfurosa	As'	Alk,BDUR,d,H2S,warm,STD,MNa+,MCa+2,MMg+2,BCl-,BHCO3-
370	RS	SANTIAGO	Fazenda Santa Marta	Cf-Cfa	d,N,MEIO,BFe,DFe,222Rn,DK
371	SC	SANTO AMARO IMPERATRIZ	Baln.Caldas da Imperatriz	Cf-Cfb	222Rn,222Rngas,a124,TALASSO,HIPER,HOT SPRING,N,O2,OLIGO,Si,HORO,MF-,DF-,DLi+
372	RJ	SANTO ANTONIO DE PÁDUA	Pqe. Francisco Pelingeiro	Cw-Cwa	220Rn,a14,MEIO,DDUR,warm,N,Si,BHCO3-,DHCO3-,MF-,DF-,MLi,BFe,DMg,DCO2,Iodo
373	MT	STO ANTÔNIO DO LEVERGER	Baia do Frade, Paulista, Feio e Costa Sena	Aw	220Rn,HORO,222Rngas,222Rn,a2,ac,HIPER,HOT SPRING,O2,OLIGO,Mflow,DMg2+,DFe
374	MG	SANTOS DUMONT	Nascente Termal	Cw-Cwb	e,term
375	PE	SÃO BENEDITO DO SUL	São Benedito	Cs	222Rn,ac,c,OLIGO
376	SC	SÃO BONIFÁCIO	São Bonifácio 1	Cf-Cfb	222Rn,d,diet,DF-
377	PE	SÃO CAITANO	Vitória	Cs	222Rn,c,term,N,MEIO,DAl+3,DBr-
378	SP	SÃO CARLOS	Bacia Corrego Água Quente	Cw-Cwa	e,warm,N,OLIGO
379	SC	SÃO CARLOS	Baln. Águas da Prata	Cf-Cfa	222Rn,ALK,b,MEIO,H2S,term,DSr+2,MF-,DF-,DLi+
380	SE	SÃO CRISTOVÃO	Pqe. Itaperoá	Am ATLANT	ac,b,term,OLIGO,TALASSO,DBr-
381	GO	SÃO DOMINGOS	Pqe.TerraRonca-Cach.Ág.Qte	Aw	TROPICSHOK,e,warm
382	RS	SÃO GABRIEL	Sanga Funda	Cf-Cfa	Alk,BDUR,d,term,STD,MCa+2,BCa+2,MMg+2,BMg+2,MF-,DSO4-2
383	AM	SÃO GABRIEL DA CACHOEIRA	Morro dos Seis Lagos	Af AMAZON	Alk,e,H2S,HIPER,MEIO,BF-,MF-,EQUAT/SAV/ARID,Mflow
384	RJ	SÃO GONÇALO	Sítio Harmonia	Aw-Cfa	222RnM,c,MEIO,EQUAT/SAV/ARID,warm,N,MNa+,MSi
385	SC	SÃO JOÃO DO OESTE	Termas São João	Cf-Cfa	STD,alk,b,BDUR,HIPER,BCl-,MSO4-2,BSO4-2,MNa+,BNa+,MCa+2,MF-,MSe+2
386	PI	SÃO JOÃO DO PIAUI	Baln. Capim Grosso	BS	CO2,d,MEIO,alk,BDUR,warm,DNa+,DCa+2,DMg+2,DK+,Mflow
387	PB	SÃO JOÃO DO RIO DO PEIXE	Baln. Brejo das Freiras	Aw' NE	222Rn,222Rngas,a1,ALK,MEIO,isoterm,MSi,BHCO3-,HORO,CO2
388	SC	SÃO JOÃO DO SUL	Baln. Vila Coceição	Cf-Cfb	TALASSO,alk,b,BDUR,term,STD,MSO4-2,BSO4-2,BCl-,MNa+,BNa+,MCa+2,BCa+2,BK+,MAl+3,MBr-,MSr+2,BSr+2,BF-,MF-,MLi+,BLi+,MMn+2
389	SC	SÃO JOSÉ	São José	Cf-Cfb	222Rn,d,N,OLIGO
390	MA	SÃO JOSÉ DE RIBAMAR	Águas da Prata	Am AMAZON	ac,d,diet,EQUAT/SAV/ARID,term,CO2
391	SP	SÃO JOSÉ DO RIO PRETO	Baln.Thermas Rio Preto	Aw	222Rn,ANTIOX,b,MEIO,HIPER,MSi,DAl+3,Mflow,MF-,MMn+2,MV+2,DV+2
392	SP	SÃO JOSÉ DOS CAMPOS	Cristagua	Cf-Cfa	222Rn,ac,c,diet,term,DV
393	MG	SÃO LOURENÇO	Baln. Oriente	Cw-Cwa	a124,ac,CO2,fria,H2S,DDUR,MEIO,MHCO3-,BHCO3-,DHCO3-,DCa+2,DMg+2,BK+,MK+,DK+,MAl+3,DBa+2,MFe,BFe,DFe,MF-,DF-,MLi+,DLi+,MMn+2,DMn+2
394	MA	SÃO LUÍS	Jaguarema	Am AMAZON	c,MEIO,term,N,TALASSO,BHCO3-,DHCO3-,DCa+2,DMg+2,DK
395	RS	SÃO MARCOS	Poço	Cf-Cfb	222Rn,CAPRICOLD,d,N,MEIO,MF-,CO2
396	SC	SÃO MIGUEL DO OESTE	2746	Cf-Cfa	Alk,d,MEIO,DSO4-2,DFe
397	PI	SÃO MIGUEL DO TAPUIO	Astroblema Brejo Onça	Aw' NE	d,astroblema
398	GO	SÃO MIGUEL DO PASSA QUATRO	Bulhões	Aw	d,diet,N
399	SP	SÃO PAULO	Rua Ág.Quente-V.Guilhermina	Cf-Cfa	CAPRICOLD,e,warm
400	SP	SÃO PEDRO	Poço SP	Cw-Cwa	ac,d,diet,term,O2+,MCu+2
401	RS	SÃO PEDRO DO SUL	Jorrante Salina	Cf-Cfa	d,Mflow,diet
402	RJ	SÃO SEBASTIÃO DO ALTO	Serra Água Quente	Cw-Cwa	MEIO,e,warm,N
403	MG	SÃO SEBASTIÃO DO PARAISO	Ribeirão Água Quente	Cw-Cwa	e,term,N,OLIGO
404	SP	SÃO SIMÃO	Sítio Santa Rita	Cw-Cwa	ac,c,CO2,diet,term,O2,MZn+2
405	PR	SAUDADE DO IGUAÇU	Fazenda	Cf-Cfb	ANTIOX,d,term,MEIO,MF-
406	BA	SENTO SÉ	Fontes Termais-Ponta Dágua	BS	e,warm

407	SP	SERRA AZUL	Poço AS	Cw-Cwa	222RnM,ac,CO2,diet,term
408	SP	SERRA NEGRA	Baln. Sto Agostinho	Cw-Cwa	220Rn,222Rn,a124,fria,N,OLIG,DBr-,HORO,MF-,DLi+,DMo+2,DV
409	SP	SERRANA	Poço SE	Cf-Cwa	ac,c,CO2,term,O2,OLIGO
410	PE	SERTANIA	Waldomiro Siqueira	Cs	Alk,c,MCl-,MEIO,BDUR,DCa+2,DMg+2,Dfe,DK
411	SP	SERTÃOZINHO	N.S. da Conceição	Cf-Cwa	220Rn,222Rngas,c,MEIO,term,N,O2,DNa+
412	CE	SOBRAL	Olho D'água do Pajé Baln	As'	b,STD,H2S,term,N
413	SP	SocoRRO	Estância	Cf-Cwa	222Rn,a14,fria,N,OLIGO,MSi
414	PA	SOURE	PT 12	Am AMAZON	d,EQUAT/SAV/ARID,term,N,MSi,MEIO,BFe,Dfe
415	PB	SOUSA	Igapó	Aw' NE	Alk,c,MEIO,term,BHCO3-,DHCO3-,DBr-,MSr+2,BSr+2,BF-,MF-
416	PR	SULINA	Baln. Hotel Thermas	Cf-Cfa	222Rn,a2,ALK,MEIO,term,BHCO3-,DSr+2,DLi+,MZn+2
417	SP	TAUBATÉ	Baln. Onsen	Cf-Cfa	220Rn,222Rngas,222RnM,alk,b,MEIO,HIPER,BHCO3-,DHCO3-,MB-3,BB-3,MCu+2,HORO,MF-,DF-
418	AM	TEFÉ	75	Af AMAZON	ac,MEIO,BDUR,EQUAT/SAV/ARID,H2S,term,DNa+,DMg+2,BFe,Dfe
419	MS	TERENOS	CNV001	Aw	ac,term,BSi,MEIO,d
420	PI	TERESINA	Carbogasosa Indaiá	Aw' NE	ac,c,CO2,term,OLIGO,BHCO3-,DSr+2
421	RJ	TERESÓPOLIS	Bairro Água Quente	Cw-Cfa	222Rn,ac,ALT,d,diet,warm,DF
422	MG	TERMÓPOLIS	Baln. Bebedouro	Cw-Cwa	220Rn,222Rn,222Rngas,b,term,N,OLIGO,HORO,DFe,BF-,MF-,MMn+2
423	MA	TIMON	Chafariz Bairro Oeste	Aw' NE	Alk,d,MEIO,TALASSO,DCa+2,DMg+2,Mflow
424	MG	TIRADENTES	Baln. Águas Santas	Cw-Cwb	222Rn,222Rngas,ALK,a4,term,HOT SPRING,MEIO,DCa+2,MAl+3,Mflow,HORO,Dfe
425	PR	TOLEDO	Sferriê	Cf-Cfa	ANTIOX,c,term,MEIO,DV
426	SP	TREMEMBÉ	São José	Cf-Cfa	d,warm,MEIO,NO3
427	RS	TRES ARROIOS	Paraiso das Aguas	Cf-Cfa	ALK,d,MEIO,term,MNa+,BNa+,MF-,DF-
428	MS	TRES LAGOAS	TLG018	Aw	ALK,d,MEIO,HIPER,DB-3,MF-,DF-,DLi+
429	RJ	TRES RIOS	São Sebastião	As-Cfa	a1,N,MEIO,DCa+2,MSr+2,DSr+2,DLi+,DF-
430	SC	TREZE DE MAIO	Lajeado	Cf-Cfb	e,HIPER
431	SC	TREZE TÍLIAS	Baln. Park Hotel	Cf-Cfb	ANTIOX,b,CAPRICOLD,MEIO,term,MF-,DF-,DLi+
432	SC	TUBARÃO	Baln.Sto Anjo da Guarda	Cf-Cfb	220Rn,222Rn,222Rngas,a1,term,HOT SPRING,N,OLIGO,TALASSO,HORO,MF-,DF-
433	BA	TUCANO	Saude Baln.	BS	a3,HIPER,N,MEIO,MMg+2,BMg+2,DMg+2,BK+,DK+,DAl+3,Mflow
434	SP	TUPÃ	Poço Termal	Aw	ANTIOX,d,MEIO,HIPER,MSi,BHCO3-,MF-,DF-
435	MG	UBERABA	Santa Helena	Aw	c,term,DHCO3
436	PI	UNIÃO	Baln. União	Aw' NE	alk,d,MEIO,term,DDUR
437	RN	UPANEMA	Santa Luzia	As'	c,EQUAT/SAV/ARID,term,DDUR,N,MEIO,DBr-
438	GO	URUAÇU	Faz. Ág.Quente S.Lourenço	Aw	e,term
439	AM	URUCURITUBA	Ferruginoso	Am AMAZON	e,EQUAT/SAV/ARID,H2S,term,Bfe
440	SP	VALINHOS	Mécia	Cf-Cwa	222Rn,c,warm,N,MEIO
441	SP	VANGLORIA-PEDERNEIRAS	Poço PED	Aw-Cwa	O2,term,N,OLIGO,DSr+2
442	GO	VARJÃO	Baln. Salobro	Aw-Cwa	d,warm
443	RS	VERANÓPOLIS	Poços Termais	Cf-Cfb	e,warm,N,MEIO,DCa+2
444	PR	VERÊ	Baln.Termal-N.S. Graças	Cf-Cfb	a2,ALK,MEIO,isoterm,DBr-,DLi+,DMo+2,DV+2,DHCO3,DB,DF
445	RS	VICENTE DUTRA	Baln. Termal Prado	Cf-Cfa	a14,alk,BDUR,H2S,term,STD,MF-,MMn+2,DSO4,DK
446	SC	VIDEIRA	Termas Oasis Parque Ág.	Cf-Cfb	CAPRICOLD,d,term
447	SP	VIRADOURO	Estancia Betel Ág.Viva	Aw-Cwa	d,diet,term,N
448	MG	VOLTA GRANDE	Vita Magnésio	Cw-Cwb	c,isoterm.DMg
449	GO	IPORÁ	Rio dos Bois	Aw-Cfa	H2S,d
450	SP	IBIÚNA	Das Orquideas	Cf-Cfa	CAPRICOLD,cold,diet,ac,c,222Rn
451	MG	UBERLANDIA	Fazenda Sobradinho	Cw-Cwa	e,H2S
452	PR	ABATIÁ	Matida	Aw	c,MBDUR,warm,alk,O2+,BSi,OLIG,MCu+2,DSr+2
453	MS	AMAMBAÍ	AMA007	Am	OLIG,warm,N,Bsi
454	RS	ALEGRETE	Pampa	Cf	ISTM,MEIO,alk,d,222Rn,BDUR,DSi,BHCO3-,DHCO3-,DNa+,DCa+2,MF-,DF-,DFe
455	PR	ANDIRÁ	P02	Cf	ISTM,OLIG,ALK,DSi,DF
456	SP	ARAÇARIGUAMA	Poço Radioativo	Cs	CAPRICOLD,222RnM
457	MS	AREADO	ARE001	Aw	OLIG,term,ac,DSi,d,DK+,DNa+
458	PB	BARRA DE SANTA ROSA	Santa Rosa	Am	term,STD,N,c,DSi,DSO4-2
459	PR	CAMPO MOURÃO	Poço CM	Cf	N,diet,CO2
460	RS	CANOAS	Araça	Cf	MEIO,warm,N,H2S,DSi,a2,BHCO3-,DHCO3-,MF-,DF-
461	MA	GRAJAÚ	Poço GRA	Aw' NE	STD,ALK,MDUR,d,BHCO3-,MSO4-2,MCa+2,MMg+2
462	AL	PILAR	Cocal	As'	ac,c,diet,EQUAT/SAV/ARID,term,HOT SPRING,DAl+3
463	TO	TUPIRAMA	Surgência 1	Aw	220Rn,222RnM,ac,diet,e,BFe,DFe,MMn+2,Dna+
464	RR	SÃO JOÃO DA BALIZA	Poço RR	Af AMAZON	N,MEIO,DCa+2
465	MT	ALTO TAQUARI	MT001	Aw	OLIG,warm,alk,Bsi
466	SP	AMERICO BRASILIENSE	Américo Brasiliense	Cs	Term,diet,N,O2+,DSi,c
467	AL	ANADIA	Dois Irmãos	Am NE	OLIG,term,ac,c,DBr-
468	GO	ANÁPOLIS	Olhos D'Água	Aw	Term,diet,ac,d
469	BA	ANTONIO GONÇALVES	Salitre Max	Aw'	ISTN,ALK,MDUR,BCl-,d,MCa+2,BCa+2,MMg+2,BMg+2,BK+,Bfe
470	MA	BACABAL	Vertente/Salgadinho	Aw' NE	TALASSO,OLIG,N,d
471	SP	BAURÚ	Baurú	Aw	OLIG,term,ALK,c,MSr+2,DSr+2,O2+
472	GO	BELA VISTA DE GOIÁS	Raio de Sol	Aw	term,diet,ac,c
473	PA	BELEM	Caranduba	Af AMAZON	EQUAT/SAV/ARID,diet,ac,d
474	RR	BOA VISTA	Monte Roraima	Aw AMAZON	EQUAT/SAV/ARID,term,diet,ac,c
475	GO	BOM JESUS DE GOIAS	Boa Vista	Aw	term,diet,ac,hot spring,c
476	PE	BONITO	Sebastião	BS	warm,diet,ac,c
477	PB	CALDAS BRANDÃO	Barro Vermelho Chaf	As'	EQUAT/SAV/ARID,STD,alk,MDUR,BCl-,d,BHCO3-,MNa+,BNa+,MCa+2,MMg+2,BMg+2

478	PB	CAMPINA GRANDE	Prof, Siqueira	Aw'	MEIO,N ,BDUR,BSi,MCl-,c,DCa+2
479	RO	CANDEIAS DO JAMARI	Vitoria regia	Am AMAZON	EQUAT/SAV/ARID,term,diet,ac,hot spring,c,MAl+3
480	RJ	CARMO	Fenix	Cw	OLIG,warm,N,DSi,c,222Rn
481	RS	CAXIAS DO SUL	Caxs	Cf	CAPRICOLD,OLIG,alk,DSi,d,DLi+,CO2
482	PA	CURUÇA	Nazaré de Macajuba	Am AMAZON	EQUAT/SAV/ARID,diet,ac,d
483	MS	FIGUEIRÃO	FIG004	Aw	OLIG,term,N,Dsi,MF-
484	SP	GLICÉRIO	Fazenda Pindorama	Aw	STD,term,alk,d,222RnM,MNa+,BNa+,MF-,MMo+2,DLi+,DMn2+
485	PR	GRANDES RIOS	P 05	Cf	OLIG,term,alk,Dsi
486	PR	GUAIRA	Guai	Cf	STD,term,alk,BDUR,MCl-,c,MSO4-2,MNa+,BF-,MF-
487	RO	GUAJARÁ-MIRIM	Guajará	Aw	term,diet,ac,hot spring,c
488	SP	GUARIBA	Guab	Cw	ISTM,OLIG,alk,c
489	SP	GUATAPARÁ	SP050	Aw	OLIG,term,ALK
490	PR	IBIPORÃ	P01	Cf	ISTM,OLIG,ANTIOX,DSi,BFe,DFe,MF-
491	MS	INoceNCIA	INC005	Aw	ISTM,OLIG,alk,DSi,DCa+2
492	CE	IPÚ	Aragas	Aw'	OLIG,term,ac,DSi,c,DBr-,MLi+,DLi+
493	AM	IRANDUBA	P 05	Am AMAZON	EQUAT/SAV/ARID,term,OLIG,ac,MCl-,DCa+2,MMg+2,DMg+2,DK+
494	GO	JARAGUA	Água da Serra	Aw	TROPICSHOK,term,diet,ac,hot spring,c,222RnM,DF-
495	SP	JOÃO RAMALHO	Figueira	Aw	OLIG,warm,alk,DSi,d,DSr+2
496	MA	LAGO DA PEDRA	Sede226	Aw'	EQUAT/SAV/ARID,OLIG,alk,DK+
497	SP	LIMEIRA	Vergine	Aw	MEIO,ALK,H2S,c,DSO4-2,DBr-,MSr+2,DSr+2,MF-,DF-,MLi+,DLi+
498	AM	MANAUS	Santa Claudia	Am AMAZON	EQUAT/SAV/ARID,term,OLIG,N,d
499	PA	MARAPANIM	Salinópolis	Am AMAZON	EQUAT/SAV/ARID,diet,N,a4
500	PR	MISSAL	Itaipu	Cf	OLIG,warm,N,DSi,c
501	SP	Mococa	Linda	Cw	OLIG,warm,N,c,DF-
502	SC	MONDAÍ	2199	Cf	STD,warm,ANTIOX,MDUR,MCl-,d,MSO4-2,MCa+2,BCa+2,MF-
503	SP	MONTE APRAZIVEL	Santa Rita	Aw	warm,diet,N,c
504	MG	MONTE CARMELO	Londrina	Cw	term,diet,ac,hot spring,c
505	RS	NOVA BASSANO	aguas termais	Cf	DHCO3,Al,DMn,d,warm,alk,OLIG,DCa+2
506	SP	NOVO HORIZONTE	Novh	Aw	ISTM,OLIG,ANTIOX,DSi,MF-,DF-
507	PE	PAUDALHO	Aldeia	As	term,diet,ac,hot spring,c
508	SP	PAULO DE FARIA	Cristo Rei	Aw	term,diet,ac,c
509	SP	PEDERNEIRAS	Pede	Aw	term,N,O2,MEIO,DCa+2,DSr+2,MZn+2,DZn+2
510	SC	PINHALZINHO	1776	Cf	ALK,BCl,DUR,warm,STD,MNa+,MCa+2,BCa+2,MF-
511	SP	PIRACICABA	Artemis Baln	Cw	ALK,MCl,d,STD,BHCO3-,MNa+, MB-3,BF,MF, MLi+
512	MS	PONTA PORÃ	PNP026	Cf	term,N,MEIO,DBa+2,MSr+2,DSr+2,DLi+
513	PE	RECIFE	Vitoria Régia	Am NE	ac,c,diet,term,TALASSO,DBa
514	AC	RIO BRANCO	Monte Mario	Aw	ac,c,diet,term
515	MS	RIO BRILHANTE	RBT006	Aw	alk,term,MEIO
516	GO	RIO VERDE	RVD001	Aw	diet,term,N,BHCO3,DNa+,DCa+2,Mal+3
517	RR	RORAINOPOLIS	Rora	Am AMAZON	c,MEIO,EQUAT/SAV/ARID,N,BDUR,DNa+,DCa+2
518	ES	SÃO MATEUS	Açaí	Aw	ac,c,diet,EQUAT/SAV/ARID,warm
519	PR	S, SEBASTIÃO DA AMOREIRA	Amoreira	Cf	c,term,N,MEIO,MF-
520	AC	SENADOR GUIOMARD	Ribeiragua	Am AMAZON	ac,c,diet,term
521	MT	TANGARÁ DA SERRA	Tags	Aw	c,diet,term,N
522	AL	TEOTONIO VILELA	Madeiras	As'	ac,c,diet,term
523	MS	CAMAPUÃ	Pontinha do Cocho	Aw	OLIG,term,alk,DSi,c,Dca+2,DHCO3-
524	TO	PALMAS	GO99	Aw'	alk,MEIO,MCu+2,MFe,BFe,DFe,MMn+2,MZn+2,BZn+2,DZn+2,BK
525	SP	CATANDUVA	Catanduva	Cw	ISTM,OLIG,ALK

SUPLEMMENTARY INFORMATION

.Brazilian recent clinical trials:

- Águas de Lindóia/SP (Taveira & Penachi, 2012): Chronic wounds
- Caldas Novas/GO (Haesbaert, 2013): Chronic wounds
- Rio de Janeiro/RJ (Cantinho & Silva, 2009): Large burns
- Peruíbe/SP (Gouvea, 2011): Gonarthrosis (Mudtherapy)
- Natal/RN (Andrade et al., 2008): Fibromyalgia (Thalassotherapy)

- Presidente Prudente/SP (Liborio & Penatti, 2007): Low back pain
- Araxá/MG (Pires, 2006): Rheumatoid arthritis
- Japi/SP (Nunes & Tamura, 2011): Dermatology
- Guarapari/ES (Mello, 1971): Rheumatology (Psamotherapy – Monazitic)

.Past clinical researchs in Brazil (almost 100 years ago = traditional medicine?):

-Poços de Caldas, Lambari, Caxambú and Araxá/MG

-Águas de São Pedro, Águas de Lindóia and Ibirá/SP

-Caldas de Cipó/BA

.Brazilian favorable natural endowment features:

- Preserved and unexplored natural endowment
- Tropical and diversified bioclimates
- Healing natural resourses =
  – Mineral Springs (Hydrodiversity)
  – Safe special mud and clay
  – Tropical Thalassotherapy unexplored places
  – Monazite Sand
  – Amazon evapotranspiration and biodiversity
  – The world lowest total magnetic field presented (nTesla)
  – The biggest litoranean band soaked by salt and hot ocean water
  – Global distinct region of high rainfall occurrence
  – Strong evidences of good air quality (low CO2, CO and aerosol size).

. Brazilian Population Behavior :

- 55% tropical
- 45% temperated
- 5% semi-arid (PLACE, 2007).

.Social and Economic Features:

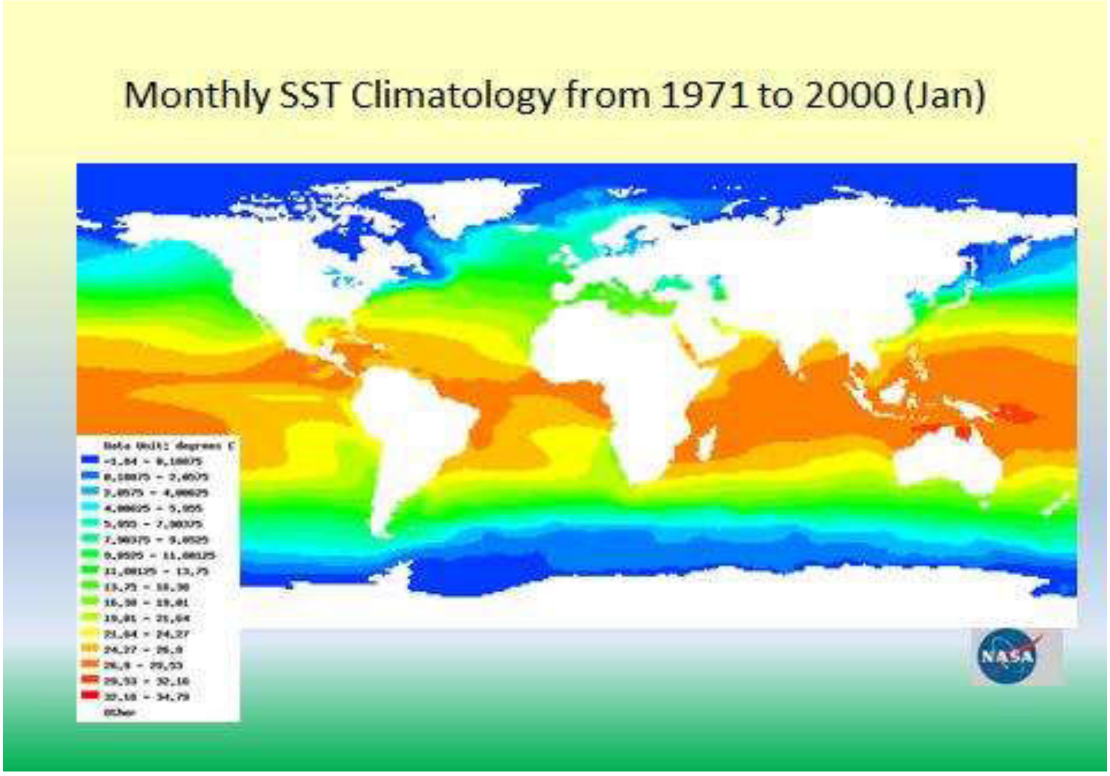
- Low Health expenditure

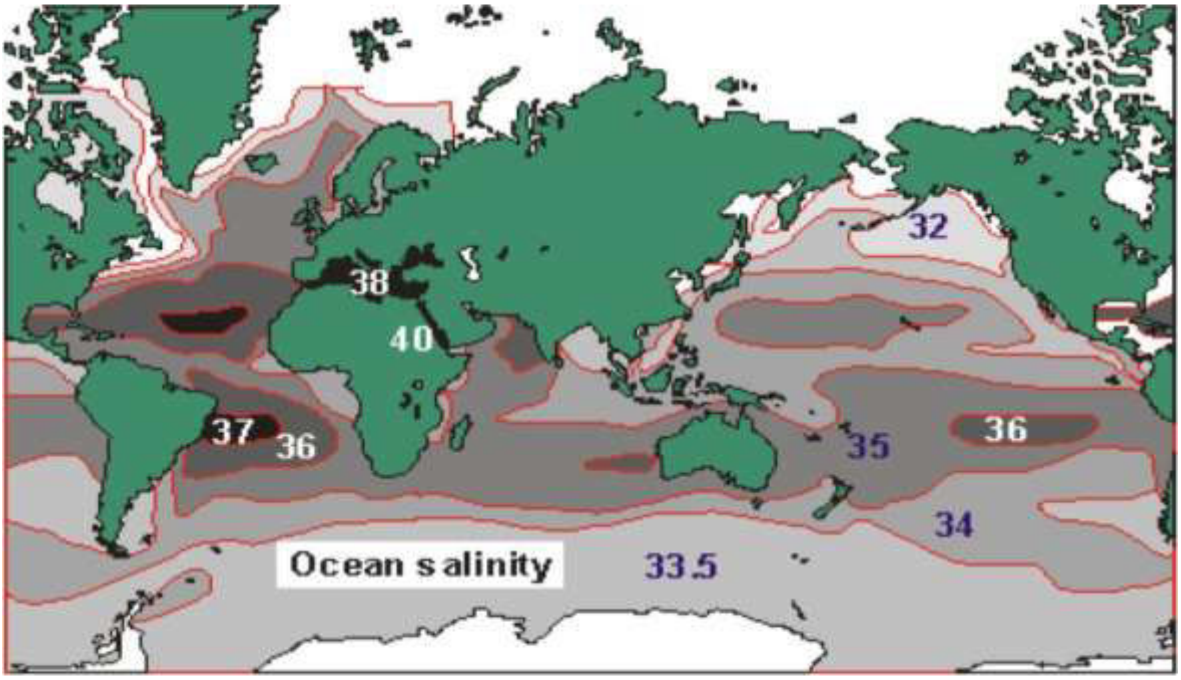
- Promissed Economy and Consumer Market
- Favorable people acceptance to CAM
- Current government support and interest in this CAM
- Medical Tourism
- Obvious need for increased scientific knowledge about these kind of clinical trials

.Having 12.6% of world freshwater resources overall (Aquastat, 2010) and much of it still preserved or even unknown; Brazil seeks the best strategies for this governance, the difficult path of sustainable development and possible adoption of ***integrated urban water management (IUWM) – Millenium indicators database*** **(UN Project, 2011):**

- Environmental health services
- May collect and dispose of health-care waste in a centralized facility.
- Provide specialist advice for identifying problems and recommending solutions for water supply, sanitation and hygiene.


Thermalism
Brazil
Top Sites
Oligomineral
Carbonated
Radioactive
Bicarbonated
Ferruginous
Sulphated
Sulphuric
Saline (Thalasso)
Mud
Monazite Sand
Bioclimate
Lazzerini, 2013


Monthly SST Climatology from 1971 to 2000 (Jan)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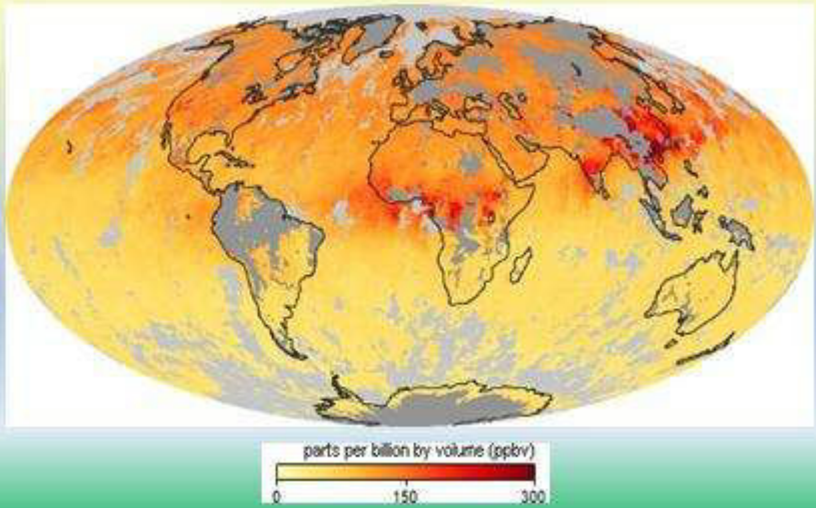
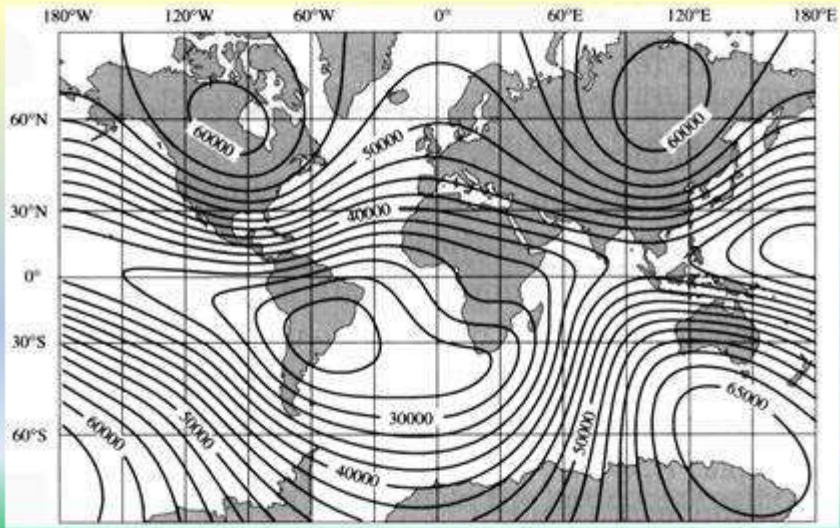
Ocean salinity
33.5

Carbon Monoxide

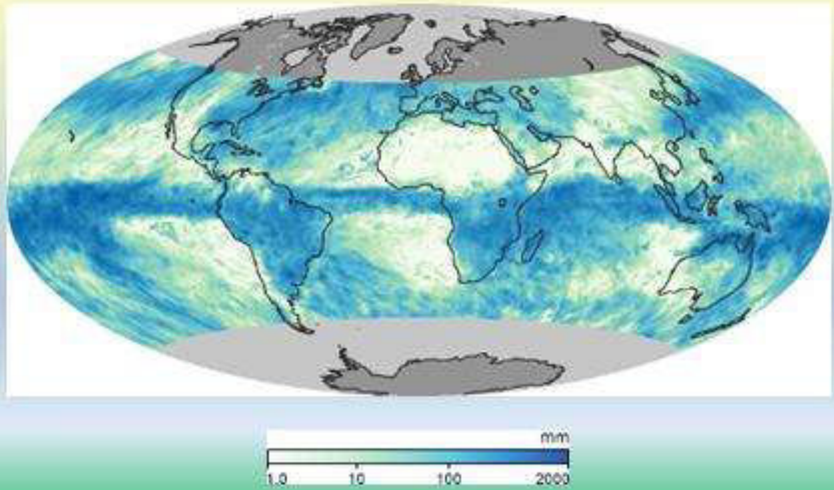


Total magnetic field presented in nanoTeslas

http://geophysics.ou.edu/solid_earth/notes/mag_earth/magnetic_field_a.gif



Total Rainfall



I - GLOSSARY

.MINEROMEDICINAL, CURATIVE OR HEALING SPA WATERS: are those that by their physic-chemical composition have therapeutic properties, curative, preventive or rehabilitation; scientifically proven or popular history recognition, through ingestion or inhalation, baths. Should be bacteriologically contaminated not, usually underground source and with minimum levels within standards. Their biological actions should be studied as a whole, whose integrity should be respected, for better clarification of its energy action, pharmacodynamics and therapeutic effects, nutritional (Mourão, 1992).

.ENVIRONMENT: set of biotic and abiotic factors that Act on bodies and ecological communities by determining its form and development. Conditions or circunstances that involve people, animals or things. As the fully of conditions that surround and sustain living beings within the biosphere, including climate, soil, water resources and the activities of other bodies (BRASIL, 2009).

.BALNEOTHERAPY: treatment of diseases by bathing, usually with thermal or mineral waters. Involve techniques recognized by total immersion of the body in the bathtub or partial of a particular part and focused. Based SPA experiences, and may replace the allopathic medicine in some cases and in others to create favorable conditions for its implementation, assist in the healing process and improve the quality of life of the patient (Bender et al., 2009).

.BIOAVAILABILITY: indicates the speed and extent of absorption of an active ingredient in a dosage form, from your concentration/time curve on systemic circulation or its excretion in the urine. BIOEQUIVALENCE: consists in proof of pharmaceutical equivalence among products presented under the same pharmaceutical form, containing identical qualitative and quantitative composition of active principle (s) (s), and which have comparable bioavailability when studied under the same experimental design; see the following figure.

.BIOLOGICALLY ACTIVE COMPONENTS or BIOACTIVE COMPOUNDS (BAC): substances (single or mixed) and means that influence physiologically microorganisms, plants, animals or humans. Its effects can be beneficial or toxic and natural or synthetic origins.

CRENOLOGY or HYDROLOGICAL MEDICINE: or thermal hydrotherapy or SPA therapy/medicine, is an ancient medical branch that studies and applies different types of waters and natural therapeutic resources in various forms and physical and chemical properties, for healing therapy and prevention of diseases. Their bases and have been scientifically demonstrated physiological efficacies through many recent publications worldwide. Despite this discipline withdrawal of Brazilian medicine courses since the Decade of 1950; does not have recognition as medical specialty in the United States, although the World Health Organization to place under legal status of complementary and alternative medicine (CAM) (Vaccarezza and Vitale, 2010; Gutenbrunner et al., 2010).

.SUSTAINABLE DEVELOPMENT: joint and long-term existence of the quality and environmental integrity, health and social equality. As well as security and economic growth (Bellen, 2004; Flint, 2007).

.HYDROGEOLOGIC DOMAIN: group of geological units with hydrogeological affinities, such as porosity, transmisivity and hydraulic conductivity.

.ELECTROLYTES: elements that allow the passage of electrons, but this does not guarantee that they can travel freely. In electrolytes electrons travel "stuck" to the ions. Strong electrolyte is a substance that is completely ionized in solvent. Their solutions conduct electricity better than the pure solute. the electrolytes are offered normally for Ionic substances ionisable.

.CLINICAL TRIAL: works on a pre-planned clinical study of safety, efficacy or best regimen of one or more medicines, therapeutic or prophylactic Diagnostics, devices or techniques in human beings selected according to predetermined criteria of eligibility and observed for evidence of favorable and unfavorable effects preset. This report methodology can also be used in pharmacology and veterinary medicine (www.clinicaltrials.org).

.EXPOSITION: contact of a chemical, physical or biological agent with the organism. Exposure is quantified as the concentration of the agent in the Middle contact integrated throughout the duration of that contact. Exposure assessment is to determine or estimate (qualitative or quantitative) of magnitude, frequency, duration and route of exposure, as illustrated in the following figure:

.SPA FOUNTAIN: localities where springs and wells with spontaneous spurt or pumping of groundwater with physic-chemical properties, materials or environments naturally Associates; that can be exploited as mineral resources or special water (premium). Such differentiation occurs by the unusual and peculiar nature of each occurrence, as well as the presence of components with noticeable biological activity.

.DRESSINGS: volatile GASES with therapeutic properties occur in the sources which has become dissolved or not in waters (ESPA, 2006).

.GEODIVERSITY: concepts fundamental research and actions considered aimed at the future use of natural occurrences (resources and/or territories) as natural resources are mineral raw materials, territories or environment; in a sustainable way, through increased knowledge and based on scientific criteria of classifications.

.HYDRODIVERSITY: varieties of waters according to their physical States, forms of occurrences, locations, origins, physical-chemical compositions, dissolved materials, types of uses, qualities, functions, etc. It must be known, valued and used based on sustainable planning.

.HYDROTHERAPY: external and internal uses of water for therapeutic purposes or welfare, its main indications are to dissolve tensions, relaxation, activating the circulation, relieve and eliminate toxins. Its effects are due to the thermal, chemical and mechanical properties of the water used in the form of friction, compresses, showers, jets, washes and immersion baths located (ESPA, 2006).

.WATER TABLE: corresponds to the surface of the separation zone of aeration, superior, inferior, saturation zone, i.e. the hydrostatic surface of the groundwater.

.SPRING or WATER SOURCE: where flow naturally, even if intermittently, the groundwater; understood that as the water contained in the underground zone of saturation, usually supported by a lower geological layer waterproof (Glazier, 2009). Can be perennials (continuous flow), temporary (only flow in the rainy season) and ephemeral (arise during the rain, staying for only a few days or hours). Constitutes Permanent Preservation Area (APP) a minimum radius of 50 meters around. Can be classified in several ways, for example:

.NATURAL REMEDIES SITES or PLACES: can mean the same as natural therapeutic resources (RNT), being the starting point in evaluating a full-service SPA and considered more effective treatments when observed under the holistic point of view (ESPA, 2006).

.NATURAL THERAPEUTIC RESOURCES (RNT abiotic): possess characteristics or components used in cures, treatments, and preventions rehabilitations. Are related to the origins and foundations of Therapeutics and currently are part of several types of therapies and medicines around the world. Can be divided to the biotic environment:

plants, animals, fungi, algae, plankton, bacteria, oils, etc. and the abiotic environment: landscapes, routes, environments, climates, Sun, heat, gases, vapors, mists, fumes, salts, radioactive sand, mud, clays, water, sludge, clay (peloid), and radon dressings minerals, crystals. Especially minerals can also be found in the bibliography as: curative thermal, medicine, remedy, therapeutic, SPA, health resort and healthy, natural resources. The main properties, classifications and laws to be detected in the assessment of these resources are related to the fields of complementary medicine, hydrological or crenotherapy medicine, preventive medicine and wellness, physiotherapy, natural therapies, hydrotherapy, bioclimatism, climatotherapy, balneotherapy, thalassotherapy, radontherapy, pelotherapy, nutrition, bottled water, pharmaceuticals, cosmetics, aesthetics, welfare, anti-aging.

.NATURAL TOURISM RESOURCES: materials or elements of nature that have attributes that can attract the visitation, recreation, leisure and well-being; but usually are represented by sites, media, places, territories, World Heritage sites, protected areas, reserves, parks, monuments of touristic interest, especially in their segments: nature, geotourism, ecotourism, rural, adventure, scientific and health tourism through the Spa, resorts, spas, SPA, wellness and resorts ". How abiotic examples: landscapes, mountains, beaches, waterfalls, rivers, creeks, lakes, springs, caves, caves, Islands, reefs, natural pools, geysers, thermal waters, ecosystems, geosites, abandoned mines, archaeological and paleontological sites.

.HYDROTHERMAL SITES: are natural or artificial, superficial manifestations of waters with temperatures other than regional annual average, especially warm or hot; and may occur as: oceans, glaciers, rivers, lakes, rain, spray, steam, rivers, lakes, waterfalls, mist, evapotranspiration, relative air unit, coast, mangrove, springs, wells and wells artesian. With possible sustainable and conservation frameworks: heritage, recreation areas, tourism, wellness and health; parks, reserves, conservation areas, protected areas, urban sustainability, geological sites, resorts, etc.

.SPA: word that can be derived from Belgium meaning source ("space") and giving name to town where it was discovered curative water in the 14th century. Also with the origin related to the Latin word "spagere" (dispersal of moisture) or as it is more accepted, the initials of the Latin phrase "Sanitas Per Aqua". SPA therapies are those that use techniques of healing and wellbeing complementary and usually as naturopathic. The main practices are: hydrotherapy, balneotherapy, climotherapy and mudtherapy (Tubergen and Linden, 2002).

.THALASSOTHERAPY: the influence of therapeutic bath of sea and sea air, in joint action with the environmental conditions of the nearby sea: turbulent ventilation, peroxide and iodized, luminosity, infrared rays (calorie), ultraviolet rays (chemical) and radioactivity. Sea water can be employed in natural sea baths (cold bain), in baths with heated sea water (balneothermotalassotherapy), in oral use (ingestion), inhalations (spray aerosol) and through percutaneous injections (subcutaneous and intramuscular).

.THERMALISM or HYDROTHERMALISM: defined as activities that research and make use of resources and natural environments, to improve the quality of life. Is the complex of medical scientific activities, tourist, business, physiotherapeutic, administrative and public; involving aspects of auxiliary medical treatments, preventive, curative, or adjuncts of natural therapeutic resources for consolidation (RNT). Is typically effected through the permanence of sick people or in SPA towns, bathing and climatic or natural sources not contaminated.

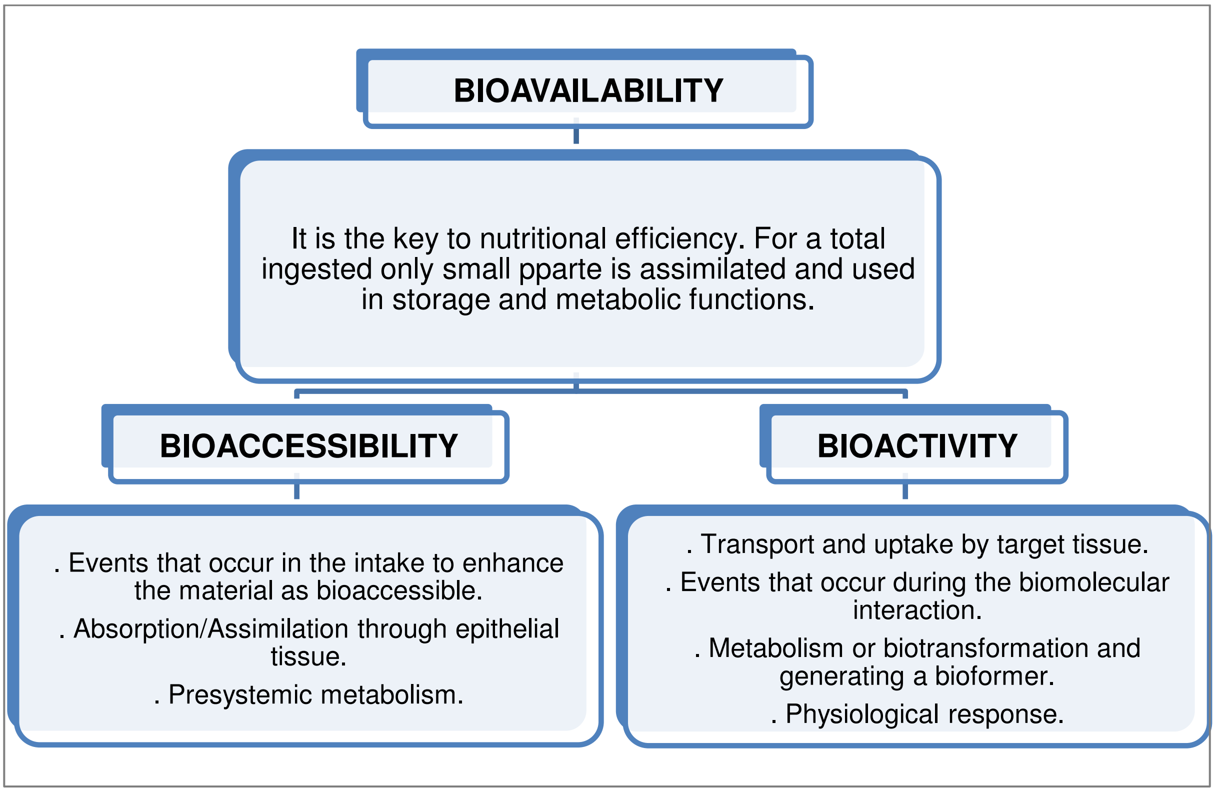
.HEALTH TOURISM: the one practiced by people moving in search of climates or treatment stations, where they can regain health (BRASIL, 2010). 2. is the tourist activity practiced by individuals or groups who move in search of natural resources or therapeutic treatment stations, where they can retrieve the physical and/or mental health. Can also be called a treatment or medical tourism.

According to their origins, groundwater and spring, can be differentiated as (Szikszay, 1993):

.1 METEORIC OR RAINWATER INFILTRATION - permeation from the ground surface and precipitated in small part by the condensation of atmospheric water vapor, rarely exceeds a temperature of 40 oC. When not moving at great depths may also be designated as vadose;

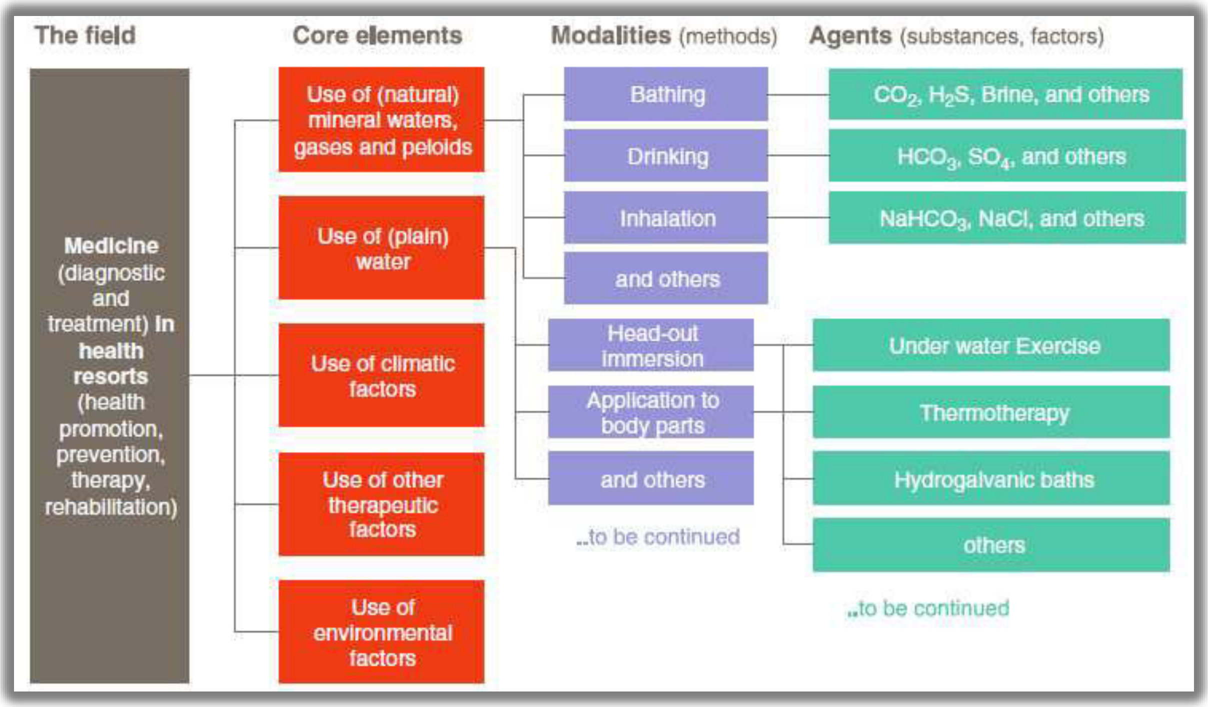
.2 JUVENILES, ENDOGENOUS OR PRIMARY - stored by the condensation of water vapor that escaped from the cooling of magma which may emerge to the surface through breaks in the crust in the form of hyper or geysers sources. May also arise secondarily released from chemical reactions between crustal materials. Its composition depends on some rocks where percolating and more reactions and volatile, or magmas genetically associated lavas. It is estimated that an average of 1 kg of granite releases 10 g of H_2O;

.3 CONNATE - marine origin that were trapped in sediments during the diagenetic processes, preserving some of the original composition.



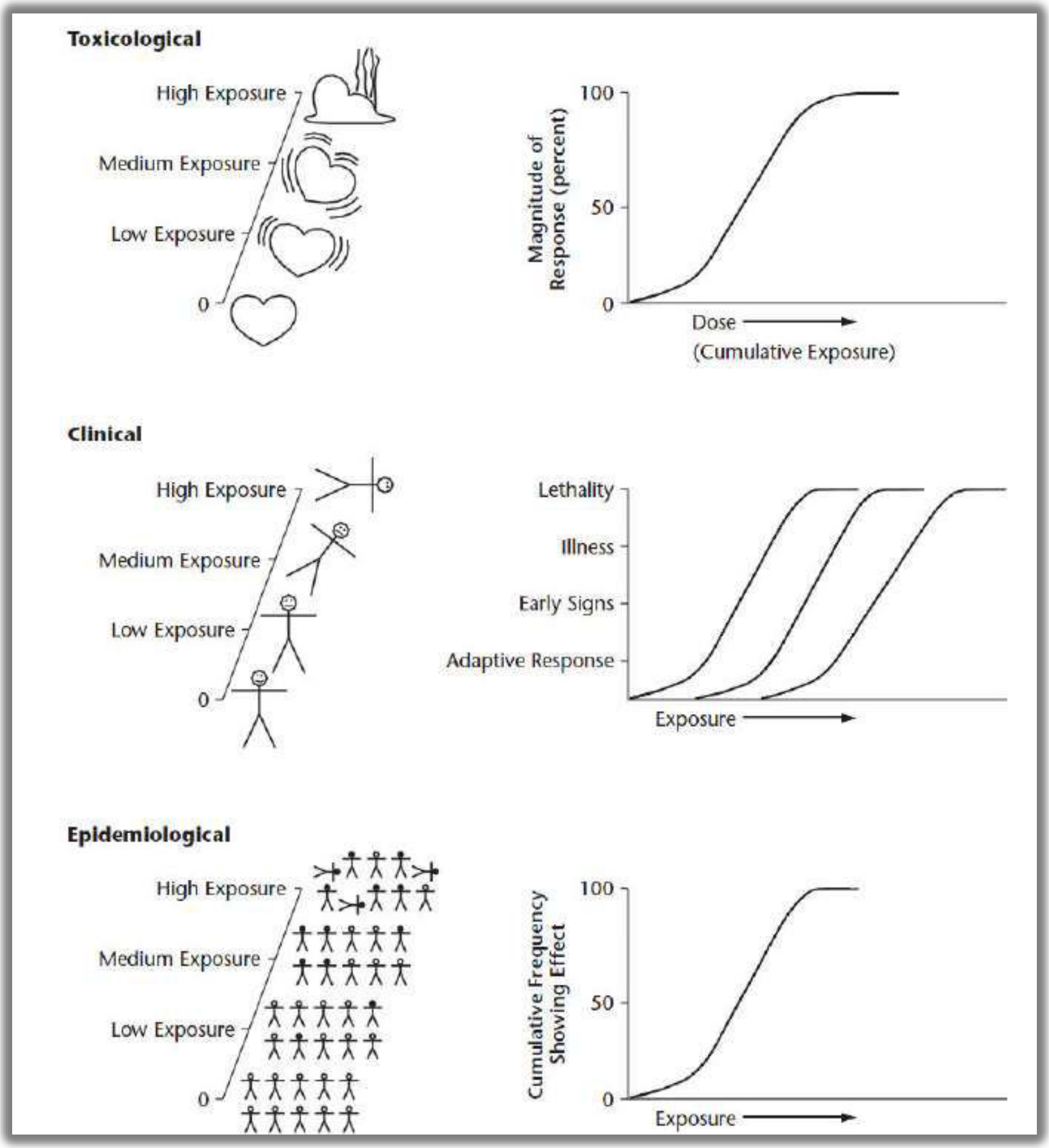
Source: Fernández-García et al. (2009)

SCHEME OF THE STRUCTURE OF THE MEDICAL FIELD



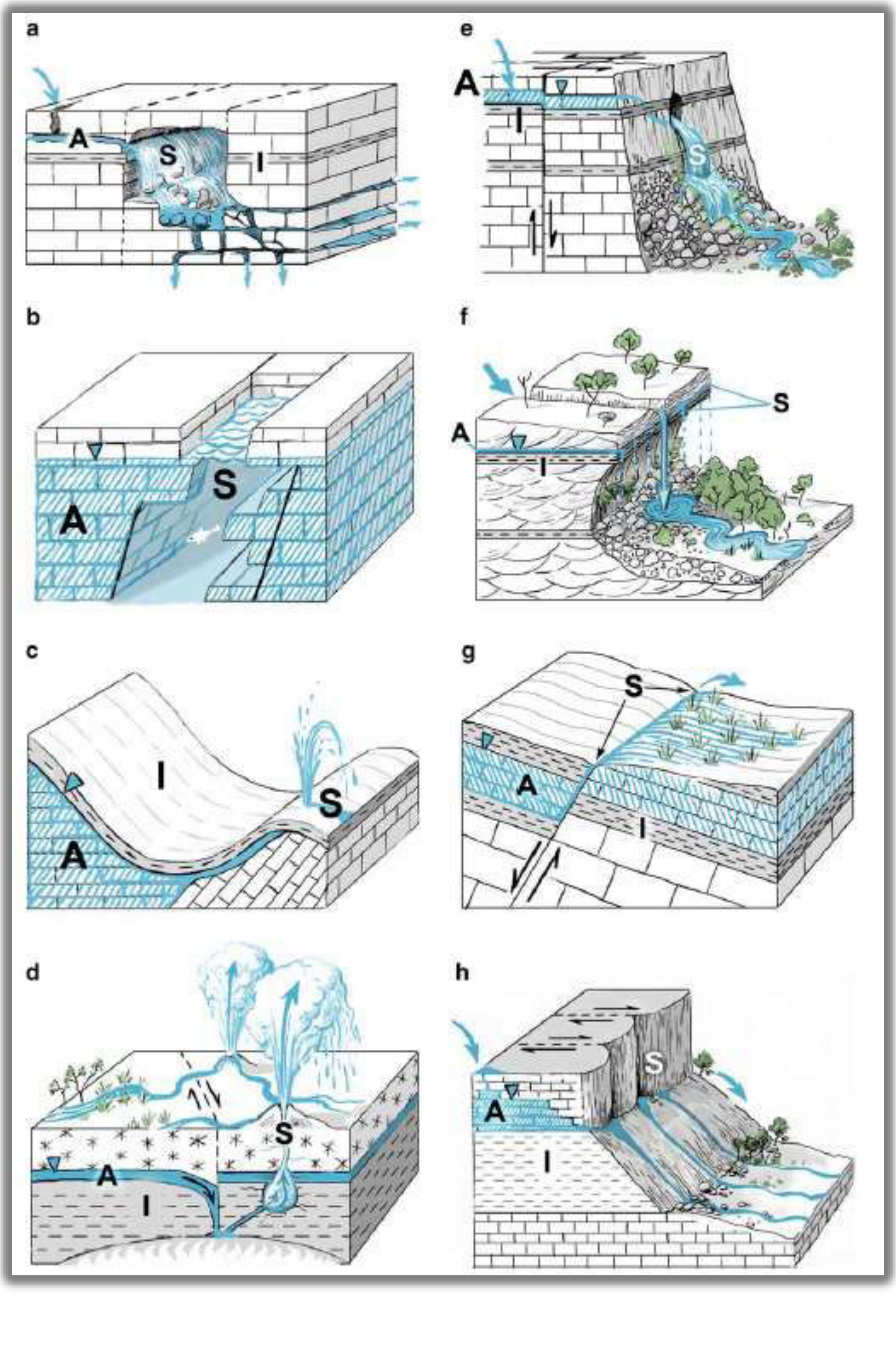
Source: (Gutenbrunner et al., 2010)

THE THREE DISTINCT VARIETIES OF THE EXPOSURE-RESPONSE RELATIONSHIP



(Robson and Toscano, 2007)

DIAGRAMS BLOCKS-ENVIRONMENTS IN THE AREAS OF HOT SPRINGS DISCHARGE



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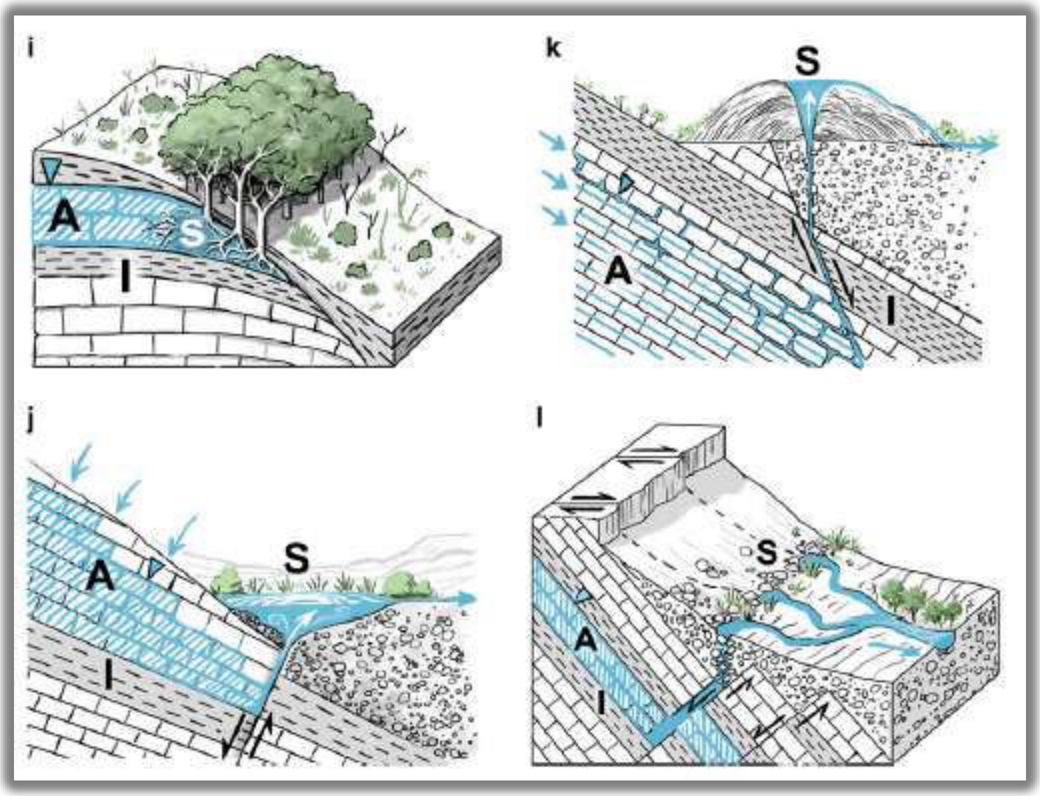
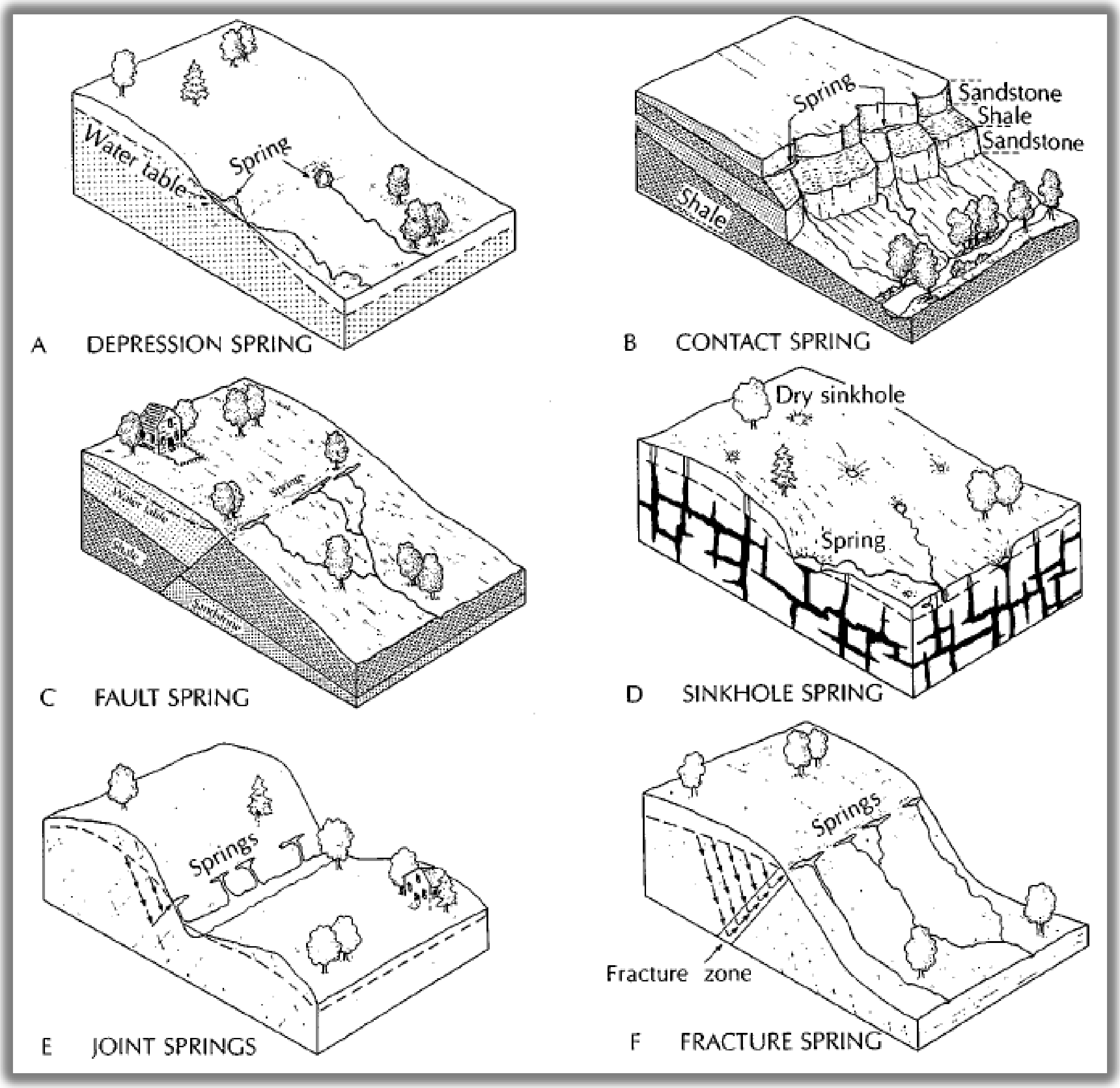


Sketches of springs spheres of discharge: a cave, b exposure, c fountain, d geyser, e gushet, f hanging garden, g helocrene, h hillslope, i hypocrene, j limnocrene, k mound form, l rheocrene. A aquifer, I impermeable stratum, S spring source. The inverted triangle represents the water table or piezometric surface. Fault lines are also shown, where appropriate. Source: Springer and Stevens (2008).

TYPES OF SPRINGS AS TO THE ORIGIN



Source: Fetter (1994)

ABBREVIATIONS

LIST OF SYMBOLS AND ABBREVIATIONS

- Ordinal position in the database.
PT (#) - Listed on SPRINGS Georeferenced Point and BRAZIL.
BAC - Biologically Active Component.
BALN (BALN / SPA / ONSEN) - Criterion External Uses for baths, Techniques

Spa and Onsen (selected by preceding the letter "B" BAC).
DIET (NUTRITION / DIET / epidem) - Criterion Nutrition, Diet and Epidemiology (BAC predates selected by the letter "D").
USA - United States of America.
EUR - European Union.
Gr - Group Natural Property of BAC.
j - Well gusher.
l - Location Hot Water.
LEG / BRA - Criterion National Legislation related (BRA - Brazil).
LEG / WORLD - Criterion Legislation Interactional correlates (WORLD - world).
MED - Criterion Clinical Trial Biomedicinal (predates selected by BAC letter "M").
n - East.
N - Amount of Variable.
p - Well.
PIC - Medical Practice Integrative Complementary (Alternative).
ppb - Parts per Billion.
ppm - Parts per Million.
REF - References Used.
SPA - Current Development of Water For Health (GLOSSARY).
BRAZIL SPRINGS - Database Hidrominerais Sources of Brazil (itself).
STD - Total Dissolved Salts.
UF - Colleges Federation (State).
WHO - World Health Organization
STD: Total Dissolved Solids

MS
DNPM
MME
CONAMA
CNRH
ANA
BAC
RNT
PIC
CAM
CAIM