NATURAL HOT AND MINERAL WATER RESOURCES OF SOUTH CENTRAL COAST REGION OF VIETNAM IN HEALTH TOURISM

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ABSTRACT

According to the results of the basic survey on mineral resources, nearly 400 hot and mineral springs have been discovered in Vietnam, of which 55 springs were investigated in the South Central Coast region with the results of physical and chemical analysis in relatively complete. The presence of natural hot and mineral springs has created an excellent opportunity to develop this region into an ideal destination for health tourism. In the study region, balneology, using natural mineral waters for the treatment and cure of disease has a history of hundreds of years. Most of hot and mineral springs that coincide or close to landscapes are very convenient for development into interesting attractions, increasing the attractiveness of the tourist ensemble. In this article, we will present the main characteristics of hot and mineral resources in South Central Coast Region of Vietnam in order to assess their potential in health tourism.

Keywords: mineral spring, hot spring, health, tourism

1. INTRODUCTION

Health and recreation tourism is a type of tourism combined with the maintenance or enhancement of personal health. Health and leisure travel is not a new type of tourism, the International Union of Official Travel Organizations (IUOTO), the forerunner of the World Tourism Organization (UNWTO) has introduced the concept of Health tourism is *"consists of the provision of health facilities which utilise local natural resources, including mineral water and climate "* (1973). Since then, health tourism activities are expanding and diversifying, health tourism can understand the travel for the purpose of rest, relaxation, health care physically. and spiritual, distinguish it from medical tourism is travel combined with the purpose of medical examination and treatment by both surgical and non surgical.

The South Central Coast has complex terrains, hills - mountains - forests - intertwined beaches create many wonders, scenic majors and beaches with blue sea, white sand, sunshine romantic. This is a very favorable condition for the provinces in the region to develop tourism with the focus on sea-island tourism. In addition, the South Central Coast of Vietnam has abundant hot and mineral springs in terms of quantity and diversity of ionic salts, mineralization, temperature. In particular, the hot and mineral springs contains a number of rare and valuable metallic trace elements that play an important role in healing, the chemical and food industries, etc. Many hot and mineral springs are identical with or near scenic places, so can be built into interesting attractions, enrich and increase the attractiveness for the general tourist ensemble. Thus, health and recreation tourism is well-suited as a complementary

sector to the unique tourism of the South Central Coast of Vietnam, to enrich the experience of visitors in the region.

The development of health and recreation tourism is also in line with the development orientation of tourism industry in Vietnam in the coming time, it is *"to promote the development of high quality products and services, attract the market part with high expense ability"* (Vietnam Tourism Industry Development Strategy to 2025, orientation to 2030).

2. BACKGROUND OF STUDY

Human needs in society are increasing in health and wellness amongst all groups in society is the foundation on which the modern health resort and spa industry is building an increasing supply of facilities for the health (medical and wellness) and recreational visitor. This form of tourism is estimated to be worth in excess of US $250 billion per year and to attract some 150 million active spa-goers worldwide (International Spa Association ISPA, 2007).

This recent trend towards health, wellness and indulgence in a relaxing environment, which according to Foster and Keller (2008) began after World War II has turned into a global movement. The new emphasis lies in prevention of disease and maintenance of good health more than the cure of illness, with high expectations regarding health improvements even if there are no particular health problems. Along with the body, the mind and soul are also catered for in many spas in a holistic approach of creating harmony through alternative treatments often including new age elements (holistic and alternative healing therapies including herbal remedies, cleansing and detoxification, aroma therapy, Ayurveda etc.) as well as the more traditional water-based therapies.

Nevertheless, the key element in many health resorts and spa facilities is water. Be it as a part of the natural landscape surrounding a spa facility (ocean, rivers, lakes and waterfalls), or as part of the background decoration and man-made landscaping (pools, fountains, artificial water features), or an active treatment component (therapies using geothermal waters, drinking mineral water, ionised water etc) water is a very important element in the contemporary world of health and recreation. A trend towards natural looking environments or settings is also evident in the marketing of many health resorts and spas, where swimming pools and geothermal bathing facilities are designed and built to look as natural as possible, with rock pools (Erfurt-Cooper & Cooper, 2009).

Natural hot and mineral spring resources are important for the development of health resort and spa destinations. While there is popular literature on health and wellness spa tourism available, a paucity of in-depth academic analyses relating to the geophysical origin of the therapeutic waters (other than related to the science of geochemistry or micro bacteriology) and their significant contribution to traditional healing methods, to the environmental management of geothermal spa tourism, or on the importance of geothermal springs to health, wellness and recreational tourism as a whole is evident (Erfurt Patricia J., 2011).

The study region has a rich and varied natural hot and mineral water resources, which are used for different purposes, first of all for medical treatment and health tourism. In fact, over the past half century, a number of sources have been exploited to effectively serve the needs of community health care. Unfortunately, due to the lack of proper attention of the authorities, activities in the field of hydrotherapy in our country have not been able to develop in time with the modern socio-economic requirements. This study aims to contribute to the promotion of Health tourism based on mineral water resources, commensurate with the region's potential.

3. GEOLOGICAL CHARACTERISTICS

The study area is located in the Andean magma arc in the late Mesozoic era, the main component is ryolite, andersit and granite (Fig. 1). The calcium-alkaline rocks are believed to have formed from from the sinking southwest of the Pacific continent in the western edge of Asia - southeast Asia continent (Taylor and Hayes 1983). This magma arc was first formed on the continent of southeastern China from the Jurassic Period to the beginning of the Cretaceous Period. Then moved southward to the west, to the study region in the middle of the Cretaceous, and continued to Southeastern Borneo at the end of the Cretaceous and the early Tertiary.

The study area is composed of Proterozoic base rocks, Mesozoic sediments and volcanic rock. Tertiary and Quaternary deposits, volcanic rocks, Paleozoic and Mesozoic granite are widely distributed in the study area (Hoang Huu Quy (1995)). The geological map is shown in Figure 1.

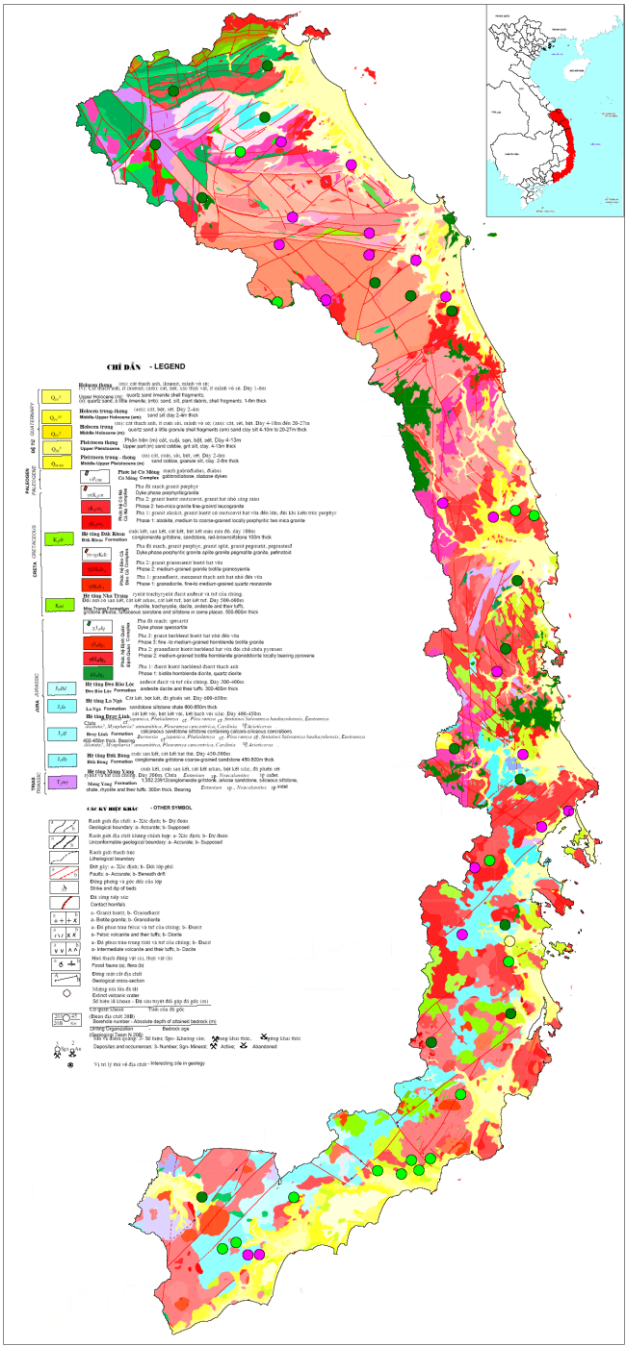

Figure 1: Geological map of studied region and location of natural hot and mineral springs (source: Hoang Huu Quy (1995))

4. HYDROGEOCHEMISTRY OF NATURAL HOT AND MINERAL SPRING IN SOUTH CENTRAL COAST REGION OF VIETNAM

Results of water samples analysis of natural hot and mineral springs were collected from previous research projects and are summarized in the diagrams in Figures 2 and 3.

In the diagram is composed of the 3 anionic components of HCO_3^- - Cl^- - SO_4^{2-} (Figure 2), the location of the majority of water samples of hot and mineral springs at the HCO_3^- corner. This proves that geothermal liquid is of meteorological origin. A few samples of mineral springs distributed near the Cl^- range of the distribution of balanced magma water or mixed with seawater.

The results of the water sample analysis of natural hot and mineral were used to plot the triangle with the 3 corners $Mg^{1/2}$, K/100, Na/1000, with the temperature division and the range of expression for the balance between the elements in geothermal liquids with the surrounding rock in geothermal reservoir.

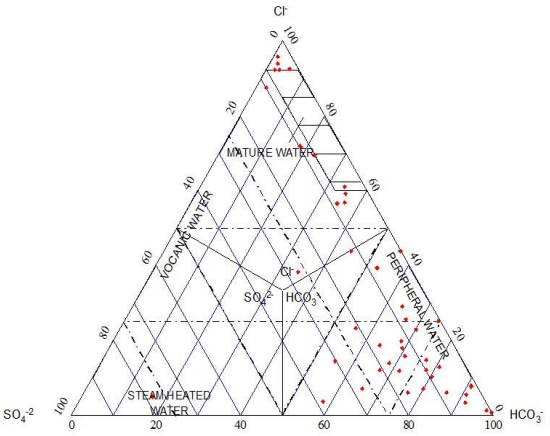

Figure 2: Water type classification of the hot springs using HCO_3^- - Cl^- - SO_4^{2-} diagram

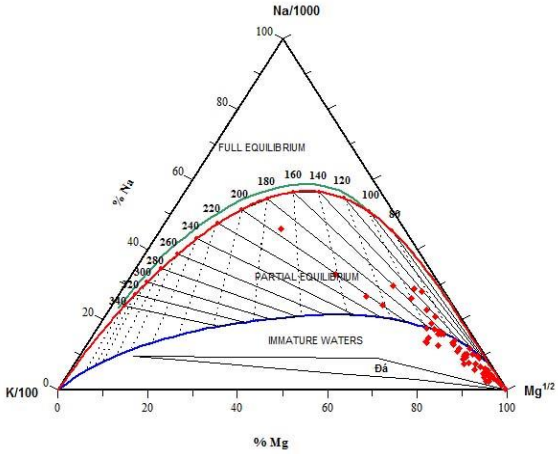

Figure 3: Giggenbach's Na-K-Mg triangular diagram for the hot springs from study region

On the Giggenbach's Na-K-Mg triangular diagram (Fig. 3), the liquid of geothermal sources in the South Central Coast region has a temperature less than 190°C, which is mainly in the range of immature waters or partial equilibrium. This means that the liquid does not have to flow from the center of the geothermal reservoir, but rather the mixture between the liquid from the geothermal reservoir and the water from ground surface so that it does not reach the state of equilibrium.

Depending on the composition and special properties, natural hot and mineral water is classified into 11 types as shown in Table 2. The criteria for classification of hot and mineral water are used in accordance with Vietnamese standards. There are 9 types of natural hot and mineral water in the study region. In particular, many hot and mineral springs are classified into 3-4 different types of mineral water by the simultaneous 3-4 factors. For example, springs Chau Cat, Phong Dien, Dong Kho in Binh Dinh, Phu Ninh in Quang Nam, Nghia Thang in Quang Ngai, etc.

Table 2: Classification of natural hot and mineral springs in the South Central Coast of Vietnam

Classification criteria	**Content**	**Type of springs**	**Number of springs**
Free CO_2 (dissolved)	≥ 500 mg/l	Carbonic	5
Total content $H_2S + HS^-$	≥ 1 mg/l	Sunphur	2
Content of $H_2SiO_3^+$	≥ 50 mg/l	Silic	42
Content of $Fe^{2+} + Fe^{3+}$ (Iron)	≥ 10 mg/l	Iron	0
Content of F^- (Flor)	≥ 1,5 mg/l	Flor	45
Content of As^- (Arsen)	≥ 0,7 mg/l	Arsen	1
Content of Br^- (Brom)	≥ 5 mg/l	Brom	5
Content of I^- (Iod)	≥ 1 mg/l	Iod	0
Content of Rn (Radon)	> 1 nCi/l	Radon	1
Content of Ra (Radi)	> 10^{-11} g/l	Rađi	2
Temperature	≥ 30°C	Hot	51

5. NATURAL HOT AND MINERAL SPRINGS IN TOURISM

Tourism based on natural hot and mineral springs therefore caters for the demand by visitors who rely on the beneficial mineral content of natural hot springs for the purpose of improving their health, but also for tourists with an interest in the visual effects of geothermal phenomena such as extreme hot springs (e.g. geysers and sinter terraces). Hot spring tourism is an important subsector of nature-based tourism, but also includes links to the historical and the cultural heritage related use of natural hot and mineral springs.

Natural hot and mineral springs are recognised by the tourism industry as a unique natural resource and frequently marketed in combination with other local attractions (e.g. cultural, historical, geological). They not only provide a resource for health and wellness tourism, but also contribute to the demand for recreational aspects of nature-based tourism. Hot springs are considered a significant drawcard for the health, wellness and recreational tourism and are developed for tourism purposes where possible. The results of recent studies show that the historical and cultural use of natural hot and mineral springs has been extensive over time on a global basis. Many natural hot and mineral spring have been used for hundreds of years and have been upgraded and redeveloped to build their facilities for further use (for example, Hoi Van mineral water sources in Binh Dinh, Phu Sen in Phu Yen, Danh Thanh in Khanh Hoa). Another significant point is the popularity of hot springs with all age groups, genders and socio- cultural backgrounds, especially in countries were natural hot springs can be easily accessed. Under responsible management to avoid overexploitation, natural hot springs are a renewable resource for sustainable long-term tourism development.

With 09 types of natural hot and mineral water have been discovered, the study area is the convergence of most of the major natural hot and mineral water known in Vietnam, mineral water has been used to treat many different diseases. In addition to meeting the healing needs of hospitals, nursing homes, many good mineral water sources (moderate mineralization, containing many useful elements ...) have been used used for bottling into pharmaceuticals or functional foods sold to the market, serving the consumer widely, for example: natural fluoride mineral water is used to prevent tooth decay, osteoporosis, iod - prevention of neck disease, carbonic mineral water - are good for the digestive organ,... Also to mention some precious resources often associated with natural hot and mineral springs. That is the deposition of mineral muds formed where the natural hot and mineral springs expose. These muds have a very good healing effect with therapeutic treatments by covering or soaking, and can be processed into cosmetics (lotion). This type of muds is very rich in natural hot and mineral springs such as Mo Duc, Nghia Thang, Danh Thanh, Phu Ninh.

The study area is characterized by ecosystems with nature reserves, national parks, biosphere reserves associated with island seas and ecotourism resources extremely attractive to tourists. In addition, the diversity of cultural values with typical Cham culture, Sa Huynh culture of coastal central coastal residents and especially the cultural and historical relics are considered as important potential for the development of tourism in the region. The natural hot and mineral springs in the study area are a key tourist attraction and being exploited for commercial purposes which directly relate to tourism. Particularly among the natural hot and mineral springs of the study area include Thap Ba Hot Spring (Nha Trang). It has been invested to build a famous tourist site not only in Nha Trang but the whole country. Every year this resort welcomes and serves nearly 500,000 domestic and international visitors. The main services of this resort include: hot and mineral water bathing, hot mud soaking, sauna, massage, acupressure, selling fresh or dried mineral mud.

6. POTENTIAL USE OF NATURAL HOT AND MINERAL SPRINGS IN SOUTH CENTRAL COAST REGION OF VIETNAM

In recent years, tourists are not only traveling for the purpose of enjoyment, sightseeing, and a lot of people are interested in health care. Health care and recreation based on natural hot and mineral springs include the organization of soaking and bathing activities at natural and hot mineral springs containing many beneficial trace elements. Virtually every type of health care, including psychiatry, alternative treatments, convalescent and rehabilitation care are or can be made available. In addition, a popular service that tourists prefer is the type of mineral mud used in the treatment of soaking is also very effective in health care. Basic services of health tourism can be directed to:

- *Resort tourism combined traditional healing:* building and upgrading resorts based on natural hot and mineral springs providing therapeutic treatments of traditional healing and traditional medicine, which is being also in a strong development trend now. Some natural hot and mineral springs in the region have been exploited and increasingly confirmed high value in exploitation as Phuoc Nhon, Than Tai (Da Nang), Tay Vien (Quang Nam), Nghia Thuan, Thach Bich Nha Trang, Cam Ranh, Danh Thanh (Khanh Hoa), Tan Mui A (Ninh Thuan), Vinh Hao, Da Kai (Binh Thuan) ....
- *Heath tourism in combination with eco-tourism:* In the region, it is possible to combine resort tourism based on natural hot and mineral springs with ecotourism and natural scenery, because there are many places with famous sites, historical and cultural sites. Tourists can experience local culture
- *Heath tourism in combination with beauty spa:* This is a product that is being combined with aesthetic center with high professional level, system of technical facilities and professional prestige creating a product of real quality and distinctive local

The Potential for exploiting hot mineral water features in the South Central Coast of Vietnam with different types of tourism is shown below.

Table 3: The potential for tourism of hot mineral water sources in the South Central Coast of Vietnam

Location	Specific value	Specific products	Supplementary products
- Phu Ninh Lake ecological zone (Quang Nam province) - Thap Ba Hot Spring Resort, Tram Trung (Nha Trang province), - Nui Chua National Park (Ninh Thuan province)	Natrural hot and mineral springs with high mountains, river systems, lakes, streams, waterfalls.	Health tourism combined with ecotourism; Traveling, exploring the natural landscape of mountains, lakes, streams and waterfalls; Mountain, lake tourism, Health and recreation tourism based on natural hot and mineral springs; Adventure tourism; Water tourism.	Travel experience and discovery; Community tourism; Green travel associated with nature; Weekend travel.
- Nui Chua National Park (Ninh Thuan province) - Ta Cu forest (Binh Thuan province)	Natrural hot and mineral springs with ecological value, biodiversity in nature reserves; national parks	Travel and sightseeing, experience the natural landscape; Researching, and exploring ecological and landscape values; Holidays, weekend tourism; Travel to have the experience of ethnic community living in the area	Green tourism, associated with nature; Weekend travel.

The result of the recent research confirm the significance of natural hot and mineral springs in the research region and present a new perspective in the discussion of health and recreational tourism. Natural hot and mineral springs are found in all provinces of the region and make a significant contribution to health and recreational tourism. As an alternative health source natural hot and mineral springs have the profound benefit of being seasonally independent and therefore attract visitors all year round. A high awareness about the therapeutical value of natural hot springs due to their mineral content is common throughout the related literature and this also demonstrates the potential of hot springs in the South Central Coast (see Table 4). Medical treatment based on natural hot and mineral springs has been initially supported by the health sector by clinical studies and has shown the significance of natural hot and mineral springs due to the success rate of treatment.

Table 4. The therapeutic value of the mineral content of natural hot and mineral springs

Type of mineral water	Therapeutic value	Spring
Arsenic	While arsenic in larger doses is toxic in the human body, minute amounts may assist the body with plasma and tissue growth. Foot bathing in mineral waters with a high content of arsenic is used to address fungal conditions of the feet	Nghia Thang (Quang Ngai province)
Bicarbonate	Balneotherapists utilis e bicarbonate waters for bathing to address hypertension and mild atherosclerosis	Vinh Hao, Chan Cat, Long Song, Van Lam, Da Kai (Binh Thuan province)
Boron	Boron builds muscle mass, increases brain activity and strengthens bones	Chau Cat (Binh Thuan province), Tu Bong (Khanh Hoa province)
Chlorides	Saline hot springs are rich in sodium chloride. Mineral springs naturally rich in chlorides, in amounts between .5 - 3%, are considered by some researchers to be beneficial for rheumatic conditions, arthritis, central nervous system conditions, posttraumatic and postoperative disorders, as well as orthopaedic and gynaecological disease	Vinh Hao, Chan Cat, Song River, Nui Ba, Nha Me, Van Lam, Phong Dien, Ta Cu, Da Kai (Binh Thuan province); Vinh Phuong (Khanh Hoa province); Tu Son, Mo Duc (Quang Ngai province)
Sodium	Sodium and natural salts assist with the alleviation of arthritic symptoms, and may stimulate the body's lymphatic system when used in baths	Vinh Hao, Chan Cat, Song River, Nui Ba, Nha Me, Van Lam, Phong Dien, Ta Cu, Da Kai (Binh Thuan province); Vinh Phuong (Khanh Hoa province); Tu Son, Mo Duc (Quang Ngai province)
Sulphur and Sulphates	Hot Springs rich in Sulphur are used to address a wide variety of conditions, including skin infections, respiratory problems, and skin inflammations	Triem Duc (Phu Yen province); Lung Vieng (Quang Nam province)

Apart from individual concentrations of minerals and a broad temperature range, natural hot and mineral springs contain additional factors like varying pH levels, low level radioactivity as well as gases in solution. All these variables have been investigated by scientists from a range of disciplines, including geochemistry, biochemistry and microbiology (see Fouke et al, 2000; Kruse, 1997; Renaut

& Jones, 2003). Medical specialists (Ghersetich & Lotti, 1996; Jorden, 1631; Parish & Lotti, 1996) have suggested that the curative effect of natural hot springs is linked to the absorption of minerals and metallic trace elements through the skin. In studies by Parish and Lotti (1996) support the claim that skin conditions such as atopic dermatitis and psoriasis can be effectively treated by bathing in mineral spring water.

7. CONCLUSIONS

The South Central Coast Region of Vietnam has a rich and diverse source of hot and mineral water used for different purposes, first of all the ideal destination of the heath and recreation tourism industry. In fact, over the past half century, a number of natural hot and mineral springs have been exploited to effectively serve the needs of public health care. Unfortunately, due to the lack of proper attention of authorities, activities in the field of hydrotherapy have not been able to develop in time with modern socio-economic requirements.

In recent years, tourists are not only traveling for the purpose of enjoyment, sightseeing, and a lot of people are interested in health care. Health care and recreation based on natural hot and mineral springs include the organization of soaking and bathing activities at natural and hot mineral springs containing many beneficial trace elements. Virtually every type of health care, including psychiatry, alternative treatments, convalescent and rehabilitation care are or can be made available. In addition, a popular service that tourists prefer is the type of mineral mud used in the treatment of soaking is also very effective in health care. From the results of research as mentioned above, it is possible to draw some suggestions for the development of health care tourism in the study area as follows:

- Inventory, classify and evaluate the pharmacological effects of some major natural hot and mineral and mineral mud and conduct additional investigation to examine some high potential springs.
- Clinical research of using natural hot and mineral springs for treatment and convalescence in some of the most promising and favorable springs.
- Quality management of health care tourism products is the most important factor. It should be coordinated with competent professional agencies (eg Ministry of Health, Ministry of Culture, Sports and Tourism, Ministry of Natural Resources and Environment....) in quality appraisal. of the services of health care.
- Development of health care tourism requires specific orientation and planning to ensure long-term and sustainable effectiveness.
- The government should issue incentive policies in investment for the construction of technical infrastructure and support in training human resources for health care tourism. There is also a need for a government / local government organization to pool resources for the promotion of health care tourism promotion.

REFERENCES

Altman, N. (2000): *Healing Springs: The Ultimate Guide to Taking the Waters - From Hidden Springs to the World's Greatest Spas. Rochester*. VT: Healing Arts Press.

Erfurt-Cooper, P. and Cooper, M. (2009): *Health and Wellness Tourism: Spas and Hot Springs*. Bristol, UK: Channel View Publications.

Erfurt, Patricia J. (2011): *An assessment of the role of natural hot and mineral springs in health, wellness and recreational tourism*. PhD thesis, James Cook University.

Eytons' Earth (2010): *Balneotherapy and Balneology - The Science and Art of Mineral Water Therapy*. Online Document: http://www.eytonsearth.org/balneology-balneotherapy.php

Foster, L.T. and Keller, C.P. (2008): *British Columbia Atlas of Wellness*. Online Document: www.geog.uvic.ca/wellness/

Hall, C. M.(2003): *Spa and Health Tourism. In S. Hudson (Ed.), Sport & Adventure Tourism*. New York: Haworth Hospitality Press.

Hoang Huu Quy (1995): *Research report on geothermal potential from Quang Nam - Da Nang to Ba Ria - Vung Tau*. State Geological Archives. Hanoi.

International Spa Association ISPA (2007): *2007 ISPA spa industry study*. Presented at the ISPA Conference & Expo, Kissimmee, Florida, November 12–15. Online Document: www. experienceispa.com

Jasen, P. (1995): *Wild Things: Nature, Culture and Tourism in Ontario 1790-1914*. Toronto, Canada: University of Toronto Press.

Ministry of Natural Resources and Environment of Vietnam (2014): *Regulations on classification of resources and reserve of natural hot and mineral water*. Circular No. 52/2014 / TT-BTNMT dated 9 September 2014.

Parish, L.C. and Lotti, T.M. (1996): *Commentary. In Clinics in Dermatology*. Vol 14 (6) pp 547-548.

Renaut, R.W. and Jones, B. (2003): *Sedimentology of Hot Spring Systems*. In Canadian Journal of Earth Sciences. Vol 40 pp 1439–1442.

Seyed Zahed Mousavi, Saeid Jalilinasrabady, Jalil Ghalamghash (2015): *Touristic Potential of Meshkinshahr Geothermal Resources, NW Iran*. Proceedings World Geothermal Congress. Melbourne, Australia, 19-25 April 2015.

Swarbrick, N. (2006): *Thermal Pools and Spas*. Online Document: Te Ara - the Encyclopedia of New Zealand, http://www.TeAra.govt.nz/en/thermal-pools-and-spas (accessed 6 September 2018).

World Health Organization WHO (2006): *Constitution of the World Health Organization*, Basic Documents. Forty-fifth edition. Online Document: http://www.who.int/governance/eb/who_constitution_en.pdf