

## BOOK REVIEW

### ***STORIES FROM A HEATED EARTH OUR GEOTHERMAL HERITAGE***

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*Fact or fiction?* People in several Korean communities got so fed up with lepers and other diseased folks over-running their villages to bathe in their hot springs that they poisoned the springs with dead dogs and even buried the springs so they could no longer be used.

*Fact or fiction?* Icelanders complained about the nuisance of hot springs on their farms to convince the tax assessor to set a low value on their properties.

*Fact or fiction?* The French Revolution nearly led to the destruction of the geothermal district heating system at Chaudes-Aigues that had been operating smoothly since the 1300s.

All of those are true and represent but a few of the fascinating items to be found in *Stories from a Heated Earth - Our Geothermal Heritage*. This handsome volume is a collection of articles skillfully assembled into 34 chapters by three editors well-known in the geothermal community: R. Cataldi from Italy, S. F. Hodgson from California, and J. W. Lund from Oregon. There are stories from at least 41 countries, written by 47 individual authors, within its 588 pages. The book is jointly published by the Geothermal Resources Council and the International Geothermal Association.

This is indeed a weighty tome; the sewn paper-bound volume measures 8.5 x 11 x 1.5 inches and weighs about 3.5 pounds. The book is most pleasing to the eye, beginning with the handsome cover designed by J. Spriggs, a wood-block print—*Boy and Mount Fuji* by Hokusai, depicting a lad seated on a leaning tree branch, contemplating the majestic mountain—set on a red background with elegant white lettering. There are some 215 illustrations—photographs, line drawings, paintings and sketches. These are mainly black and white, but there are six in full color counting the cover.

The table of contents is well organized; the chapters are arranged by region of the globe. The volume begins and ends at Easter Island, and the stories travel around the planet stopping at nearly all countries or areas that have geothermal resources of any kind. Although the editors say that not all countries are included, they have done a fine job of selecting a most representative set to tell the tale of geothermal energy around the world and through time.

The writers generally come from the countries or regions described in each chapter, leading authenticity to the stories. The job of organizing and editing such a collection

must have been formidable, given the fact that for most of the authors, English is not their first language. M. Sekoka, the author of the chapter on Japan, expressed his feelings in his concluding section: “As the author is not an historian and English is not his Mother Language, the author has gone through all sorts of hardship.” To his and the editors’ credit, the final product is well worth the hardship.

The format for each chapter is consistent and effective. Each chapter begins with the title page on the recto and a frontispiece on the verso. The frontispiece may be a photograph, painting, piece of sculpture or other work of art. While these are all arresting and valuable contributions, my favorites are the photograph by William Henry Jackson of “Bella, a Maori guide, sitting at the edge of the Rotorua geysers” (p. 434) and the painting by Paul Kane entitled “Mount St. Helens” showing a canoe carrying eight American Indians watching a spectacular eruption of this famous volcano (p. 6). Honorable mention goes to two others: “Madam Pele” by Herb Kawainui Kane (p. 450) and the aerial photograph of Mount Mayon by B. J. Barker (p. 406).

The title page carries an abstract and an introduction together with a small map at the top of the page (Mercator projection) outlining the continents of the world. The map highlights in black the country or area covered in the chapter. This helps orient the reader as the stories progress around the globe. Each chapter is amply illustrated with numerous figures. The illustrations in nearly all chapters, however, are not numbered which makes it awkward to refer to them, particularly since there are cases of cross-references between chapters. Most chapters include detailed maps to show the specific sites discussed, but I still found myself often referring to my atlas for more information.

Several chapters incorporate informative side-bars and excerpts from other literature that add significantly to the enjoyment and edification of the reader. Here we find quotations from many well-known authors, including Homer, Seneca, Strabo, Shakespeare, Poe, Twain, John L. Stephens, Frances Calderón de la Barca, and Garcilaso de la Vega.

Each chapter concludes with a summary and an extensive list of references. It must be said, however, that the references tend to be in the native language of the author, as one would expect. Furthermore, many are in the so-called “gray literature” and are probably inaccessible for the average reader. For readers wishing to delve further into the material,

they may reach the authors directly since there is a complete set of information on each author at the end of each chapter, including telephone and facsimile numbers, and in most cases, e-mail addresses. The lack of an index in a book of this size and scope is disappointing.

Many of the chapters are reprints or re-writes of previously published articles (18 out of 34) that have been adapted for the present book. Most of the reprinted articles first appeared in either the *Proceedings of the World Geothermal Congress*, v. 1, sect. 2, 1995 or *Geotermia, Revista Mexicana de Geoenergía*, v. 8, n. 3, 1992.

The material is aimed at a general audience. One need not be an archaeologist, anthropologist, geologist, geochemist or engineer to understand the material. There is, however, use of specialized terminology for a wide range of fields for which a glossary would have been helpful. Since the stories go back to prehistoric times, reference is often made to various geologic periods. There are three helpful charts in chapter 2 that relate the Lower Paleolithic, Upper Paleolithic, Neolithic, the Stone Age, Metal Age, etc., to years B.C., but since reference is made to these ages throughout the texts, I found myself thumbing back to chapter 2 to get the timing straight in my mind. While the language is generally accessible, there does appear the odd sesquipedalian here and there, such as a word “autochthonous” that sent me running to my unabridged dictionary—it means “indigenous” if you did not know.

While there is not enough space in this review to comment on every chapter of the volume, I will try to convey the sense of the work and offer a few comments. The general theme is the interaction between humans and geothermal phenomena from the beginning of time, with emphasis on how geothermal energy influenced the development of civilization. This required the study of tales, legends and myths, gleaned from ancient writings, official documents, pictorial representations, and oral histories. In such matters, the distinction between fact and fiction is often blurred, and the key to understanding is interpretation.

While there is no shortage of myths and beliefs surrounding “The Creation,” the first chapter offers yet a new mythological version. Cataldi presents a geothermal-centered explanation of the beginning of it all. He continues in this vein in the next chapter by speculating on the nature of humans’ first encounters with geothermal manifestations.

Chapter 3 on the African Rift, written by Oregonian Lund (breaking the pattern mentioned earlier) unites the first humans with the forces of geothermal energy. I believe it is significant that the scientifically accepted cradle of life as we know it corresponds to an active geothermal zone. We humans may owe a lot more to geothermal than we think.

This is followed by several excellent chapters on the Middle East, Turkey, Greece and Macedonia. The reader is treated to the oldest known depiction of a geothermal event—a Turkish wall painting dating from 6200 B.C. that shows the eruption of Çatal Höyük. The mural appears twice in the volume, first in chapter 2 (p. 16) where a photo of the actual

mural is juxtaposed against a reconstruction and a modern interpretation, and again in chapter 5 (p. 53) where only the reconstruction is presented.

The book then focuses for the next seven chapters on the Mediterranean region and specifically on Italy. The attention given to Italy and in particular to Larderello (or, as it was known in the early days, the Boraciferous Region) is justified by the important advances that were made there in the areas of chemical production (mainly boric acid), space heating using geothermal fluids, integrated use of geothermal energy for industrial processes, and the first commercial generation of electricity from geothermal energy. Starting from the time of the Etruscans in 800 B.C. to the present, Italy has been at the center of geothermal development. It is an interesting and important story. Since six of the chapters on Italy are reprinted from other sources, there is considerably overlapping and repetition. In my view, the bulk of the story can be found in the excellent chapters 13 and 14 by P.D. Burgassi and Burgassi, Cataldi and C. Donati, respectively.

The low-temperature resources of the Caucasus region, Poland and France are described in the next several chapters. The story of the French village of Chaudes-Aigues, written by J. P. Gibert and F. Jaudin, is intriguing. Blessed with one of the hottest springs in all of Europe (82°C), the villagers have long put these waters to good use. Back in the 14<sup>th</sup> century, they built a district heating system that was similar in principle to the ones in operation today at many places. Water from their spring was channeled through the village. Individual houses were connected to the main channel by side channels controlled by sluice gates. Hot water flowed through ducts under the floors of the houses, into and out of a large pit dug under the house, eventually returning to the main channel. When the house reached a comfortable temperature, the gate could be closed. This system served quite well until the French Revolution in 1789, after which everyone (and no one) became responsible for its operation. Residents began filing lawsuits against one another as the system fell into disrepair. The villagers soon realized that they were about to lose a very valuable asset and this led them to establish rules and regulations for the operation and use of the waters. Most importantly, they placed an individual in charge of running the system. The spring remains in use today, and the town is the site of the Museum of Geothermics and Water Cures established in 1993.

I. B. Fridleifsson relates Iceland’s history of geothermal use in chapter 19. The island settlements got started around the year 900 A.D. Unlike in other parts of the world, early settlements were not sited close to hot springs. Since the main livelihood of the Icelanders was fishing, they preferred to live close to the ocean. The hot springs were used primarily for washing clothes, a task done by the women. The convenience of the fishermen was paramount. The Icelandic farmers disparaged the existence of hot springs on their land, exaggerating their disadvantages, to lower the value of their property in the eye of the assessor and thus, reduce their taxes. This information comes from tax documents dating from

1709, but the strategy is easily recognizable and timeless. The first attempt to capture the heat of the energy of the hot springs for heating houses was in the 1200s, but it failed. No further attempts were made for the next 700 years, a surprisingly long time given Iceland's cold climate. Of course, today Iceland leads the world in the use of geothermal energy for space heating.

A recurring story throughout the book is the therapeutic benefits of thermal-mineral waters. Everywhere the story is the same: soak your tired, weary, diseased body in geothermal waters and be refreshed, rejuvenated, and cured. There seems no end to the list of afflictions and diseases that can allegedly be cured in this way: arthritis, rheumatism, gout, syphilis, leprosy, goiter, paralysis including polio, dyspepsia, leucoderma, rashes, burns, psoriasis, fibrous tissue syndrome, eye infections, liver disease, dysentery, sexual dysfunction, gynecological disorders, et cetera. Some cultures believed that hot springs could restore virginity. Some myths would have us believe that springs could even restore life to the dead. In a remarkable passage in chapter 24, we learn that Korean villagers poisoned their own hot springs to put an end to lepers trying to cure themselves. B. W. Yum tells us that they would throw dead dogs in the pools to discourage their use, and that they even filled in and buried springs to save their villages from being overrun by these diseased outsiders who were viewed as a health threat.

A story from Japan told by Sekioka in chapter 25 deals with the export and sale of hot spring water. Entrepreneurs would scoop up and barrel water from the springs for shipment to localities lacking hot springs. This obviously was a rather inconvenient way to spread the benefits of the waters, so an innovative fellow hit on the idea of making artificial hot spring water. Following a carefully devised formula of chemicals, he was able to reproduce the alleged healing properties of natural waters. Unfortunately, the product turned out to be too expensive for the average consumer. Undeterred, he simplified the formula—by dissolving geyserite in salt water, he created his new, improved artificial spring water. Presumably, his clients did not notice any difference in the quality or effectiveness of the product.

The holistic view of natural geothermal resources held by indigenous peoples is another recurring theme. It is exemplified by the Maoris of New Zealand (chapter 28 by C. M. Severne) and Native Americans (chapter 29 by Lund), to mention only two. Recurring themes in the oral histories of diverse cultures serve to unite all the people of the world in coping with mysterious and powerful natural forces. The

notion of stewardship of a divine gift to preserve it for future generations is a commonly held principle. The conflict between this belief and modern development has created a number of adversarial situations. Several chapters deal with this issue and point out ways of reconciling the opposing positions.

The impact of geothermal energy on the early settlers of Mesoamerica and South America is told vividly in chapters 31, 32 and 34. Although these regions were isolated from Europe, Asia and Africa at the time, the similarity of the developments is striking. Again, we see that there was a common way of thinking about the great forces of nature that permeated all early peoples, regardless of where or when they lived.

Chapter 33 by Hodgson converts some current oral history from Mexicans into the written record. The stories related by A. G. Salazar are especially moving and poignant for anyone who has ever worked, traveled or lived in active geothermal areas.

The belief in animism is another of the common features of the stories of many peoples. Physical features of the landscape are thought to be alive. While hardly anyone would doubt that a tree is alive, many would question whether a mountain is alive. We plant seedlings and watch tree grow; we did not actually see how a mountain was born and grew—we can only glimpse this through our intellect. It comes down to a question of time-scale relative to our own lives. It is easy to understand how indigenous peoples with a long tradition of oral history can believe in the life of mountains because the oral history lengthens the effective life of an individual to that of all their ancestors. Thus, the eruption of Mount Mazama and the creation of Crater Lake in Oregon—witnessed by Native Americans some 7,700 years ago—can be a part of the personal experience of a Native American today.

Hodgson captures this idea in the last paragraph of chapter 33: "Birth and death. Like us, geothermal features begin and end, moving through cycles of their own. We draw towards them, lured by change, beauty and an unusual cast of the familiar—water, rocks and heat. We search them for answers to mysteries in our own lives, like birth and death. We have done this through time, and geothermal stories are the archives of our quest."

The authors have succeeded in their objective, namely, to show how "applications of geothermal resources stand not alone but on an historical continuum." Their unique volume is a valuable addition to the historical literature of our geothermal world.