

Preface

Geothermal energy is one of the new and alternative energy resources that have not yet rivaled the main energy resources (hydropower, coal, petroleum, natural gas, or even nuclear). Nevertheless, the Earth is a huge heat reservoir with abundant geothermal energy, which has the potential to impact the energy demand of many countries throughout the world. Due to the difficulty in development and the demanding huge investment, the use of geothermal energy has been very slow before the 1970s. The petroleum crisis in early 1970s was one major factor affecting the study and development of the geothermal energy. During that period, many provinces of China began to investigate in large-scale use of geothermal energy and went beyond the balneology of thermal springs. The Geothermal Research Section of Geology Department of Peking University emerged at the time of 1970, when I was fortunate to join this Section. We collaborated with the power system to construct a pilot station of 200 kW using 79 °C hot water. The station has become one of the seven pilot plants on the east of China mainland. But our goals were Larderello, Wairakei and The Geysers. Our Section decided to visit Tengchong volcanic area in Yunnan Province to seek high-temperature geothermal fields from 1973 winter to 1974 spring.

Qinghai-Tibet (hereinafter called Qingzang) Plateau is a collision zone of continent crust between the Eurasian and Indian plates, where there are many high-temperature areas owing to its unique tectonic setting. How many thermal springs are there in this region? How many high-temperature hydrothermal systems? How high are the temperatures? The answers were unknown before 1970s. To find the answers, the Chinese Academy Science formed Qinghai-Tibetan Plateau Scientific Expedition in 1973, a Geothermal Project Group emerges at that time. Our Geothermal Research Section joined the Expedition in 1975 and became the main force of Geothermal Group.

This book in English is the generalization and summarization of field survey data of Geothermal Project Group of Qinghai-Tibetan Plateau Comprehensive Scientific Expedition of Chinese Academy of Sciences (CAS) from 1973 to 1989. It presents readers rich and various thermal springs distributed over the Qingzang Plateau and its surrounding areas, which are steadily manifesting due to the convergence of the

two continental plates. The thermal springs over there are 1684 in total, of which 1380 springs have geochemical data for calculations of temperatures of the reservoirs. The author of this book provides a wealth of data on boiling and hot springs, including their locations, elevations, temperatures, geological data, and the analytical results of water samples, and also tables on warm and tepid springs with low temperatures. The author of this book considers that this research area is the sole high-temperature geothermal belt on Chinese mainland, called Himalayan geothermal belt or Yunnan–Tibetan Geothermal belt. Lastly, this book discusses the relationship between geothermal energy and other energies, and claims that geothermal energy could be an important supplement to the rich hydroelectric resources in the remote southwest China.

The foundation of this book is the following five monographs (in Chinese with English abstract) published over the years by the author of this book and his colleagues.

Wei T, Mingtao Z et al. (1981) *Geothermics beneath Xizang (Tibet) Plateau*. Science Press, Beijing.

Geothermal Reserch Section of Department of Geology of Peking University (1989) *Geothermics in Tengchong*, Science Press, Beijing.

Wei T, Mingtao Z compiled, Writers: Guoying G, Zhijie L, Shibin L et al. (1994) *Thermal Springs in Hengduan (Traverse) Mountain*, Science Press, Beijing.

Zhijie L, Ping Z (1999) *Yunnan-Tibet Geothermal Belt—Geothermal Resources and Typical Geothermal Systems*, Science Press, Beijing.

Wei T, Zhijie L et al. (2000) *Thermal Springs in Tibet*, Science Press, Beijing.

These monographs are written based on fieldworks, especially those done by the Geothermal Project Group of Qinghai-Tibet Plateau Comprehensive Scientific Expedition of CAS. This book is the summary and condensation of these monographs. Ever since the Qingzang Expedition ended, during the following over 20 years, the amount of thermal springs in this area has not changed much, but the development of geothermal fields makes a bit headway.

The author of this book thanks our stellar researcher-writers, without whom this book would be a pile of blank pages. The wealth of data in books are taken from field researchers of the Geothermal Group, who overcame plateau reactions and every difficulty. Their outstanding work will always be cherished in my memory. Over the years, the following scientists have participated in the geothermal fieldwork: Wei Tong, Zhifei Zhang, Zhijie Liao, Maozhen You, Meixiang Zhu, Guoying Guo, Minzi Shen, Shibin Liu (the staffs of Geothermal Research Section of Peking University, during 1975–1989), Dexin Wang, Zhiguo Mu and Baoshan Deng (from teacher of Department of Geology and Department of Geography, in 1975 or 1976), Shaonan Dai, Changyi Jiang, Jincai Lu, Fengtong Wang, Xiangmin Wang (in 1975), Baimin Chen, Xiuping Li, Jiapin Tang, Xiaohuan Xi, Shaoping Yang (1976) (more for the high grade students of Department of Geology and Department of Geograph of Peking University), Mingtao Zhang, Changjtn Zhou, Yaxin Zheng (from Commission for Integrated Survey of Natural Resources, CAS), Li Zhu, Shutang Xiao, Shaozhuo Xu, Longlin

Wu, Honglin Song, Xinhua Wang (from Chinese Geology University (Wuhan) during 1973–1974).

Many experts have been working hard in the Plateau for a long time. Though they did not participate in our study tours, they played invaluable roles in the completions of the above monographs. These experts are: Mianping Zheng (from Chinese Academy of Geological Science, Academician of Chinese Academy of Engineering), Dorjee (Academician of Chinese Academy of Engineering), Tingli Liang and others (from Tibet Geothermal Geological Brigade), Dengzhujiacan and others (from Tibet Geothermal Development Company), Fangzhi Wu (from Ministry of Power Industry), Xizhi Jia and Xiyi Jia (from the Second Hydrogeology and Engineering Geology Brigade of Yunnan Geology and Mineral Resources Bureau), Prof. Mei Luo and Prof. Shuyuan Jia (from Chendu Geology Institute and PLA00933 Troops). They also provided a wealth of information of local thermal springs.

Unfortunate, my colleagues Prof. Wei Tong and Prof. Zhifei Zhang, whose calm guidance in fieldwork and writing made a daunting project possible, and Mr. Shibin Liu, have passed away. Their contributions to Chinese geothermal development would be forever memorized.

Lastly, the author of this book wishes to thank Dr. Yujie Wu, my American friend, who proofread my first draft in English, without his help there would inevitably be many language errors. The author of this book also wishes to thank Ms. Ying Wang and Ms. Haijie Jin, as well as Higher Education Press, for their help to typeset all figures. These works are very difficult for me, an 80 years old man.

Beijing, China

Zhijie Liao

Thermal Springs and Geothermal Energy in the
Qinghai-Tibetan Plateau and the Surroundings

Liao, Z.

2018, XIV, 311 p. 37 illus., 8 illus. in color., Hardcover

ISBN: 978-981-10-3484-8