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Niedersächsische Staats- und Universitätsbibliothek Göttingen
Georg-August-Universität Göttingen
Platz der Göttinger Sieben 1
37073 Göttingen
Germany
Email: gdz@sub.uni-goettingen.de

Book Reviews

Geothermal Systems: Principles and Case Histories, edited by L. Rybach & L.J.P. Muffler, XIV + 359 pp. John Wiley & Sons Ltd., Chichester, New York, Brisbane, Toronto, 1981

This collection of twelve articles by twenty one contributors contains seven papers concerning principles and five papers presenting case histories of selected geothermal areas. The book represents scientific aspects related to geothermal energy; less attention is given to economical and technical problems. Therefore, scientists working on geothermics as well as those who are interested in that subject will find topical chapters bearing on the problem of heat extraction from shallow depths as well as of heat and mass transfer within areas favoured for exploration and exploitation of geothermal energy.

Chapter 1. Geothermal Systems, Conductive Heat Flow, Geothermal Anomalies by L. Rybach gives a very readable short introduction into general aspects of geothermics with a good physical background. It leads to find a way into mathematical modeling of heat transfer problems and it provides an understanding of irregularities in the thermal state of the lithosphere caused by the mechanism of plate motion.

Chapter 2. Convective Heat and Mass Transfer in Hydrothermal Systems by S.K. Garg and D.R. Kassoy outlines the principles for mathematical modeling to this very topic in a pleasant form with an application to selected prominent geothermal fields.

Chapter 3. Prospecting for Geothermal Resources by J.T. Lumb is an attempt to compile results that are related to the exploration of geothermal energy. In this chapter, the treatment of additional principles of the applied techniques would be of help for the reader. Also the quantitative treatment related to their usefulness to detect heat reservoirs received little attention.

Chapter 4. Application of Water Geochemistry to Geothermal Exploration by R.O. Fournier is a valuable contribution of geochemical methods to estimate the reservoir temperature in the stage of exploration as well as during production.

Chapter 5. Heat Extraction from Geothermal Reservoirs by I.G. Donaldson and M.A. Grant discusses briefly principles of extraction. The authors' experience of geothermal fields in New Zealand with reservoirs of different permeability is well represented.

Chapter 6. Geothermal Resource Assessment by L.J.P. Muffler sheds some light and gives an update on a resource assessment for selected geothermal fields. The uncertainties and difficulties for an assessment of the amount and usefulness of geothermal energy are discussed. This problem gained in significance during the last decade in an unexpected manner.

Chapter 7. Environmental Aspects of Geothermal Development by M.D. Crittenden, Jr. covers problems which arise with the utilization of geothermal energy. The author judges the environmental effects to be small compared with those of other energy sources.

The second part of the book is concerned with the case histories of a few carefully selected geothermal areas. The data are not easily obtainable elsewhere. Each contribution of this part represents the state of the art of exploration techniques for and the utilization of geothermal energy.

Chapter 8. The Low Enthalpy Geothermal Resource of the Pannonian Basin, Hungary by P. Ottlik, J. Gálfi, F. Horváth, K. Korim and L. Stegena gives well presented a general view of the thermal condition of the basin including geological aspects and

hydrogeological characteristics. The huge amount of exploited thermal water is reported to be utilized in a wide range of purposes.

Chapter 9. Exploration and Development at Takinoue, Japan by H. Nakamura and K. Sumi represents an excellent example for applying geological, geochemical and geophysical methods to explore a geothermal field that has been developed to a power plant of 50 MW.

Chapter 10. The Krafla Geothermal Field, Northeast Iceland by V. Stefánsson outlines the favoured location of Iceland for geothermal energy. The exploration of the geothermal field as well as its further development demonstrate particular characteristics in neovolcanic zones.

Chapter 11. The Geothermal System of the Jemez Mountains, New Mexico and its Exploration by A.W. Laughlin explains a geothermal system on a major structural discontinuity with young volcanism. Besides hydrothermal exploration, the "Hot Dry Rock" geothermal energy extraction method at the Fenton Hill site is outlined.

Chapter 12. Extraction-Reinjection at Achuachapán Geothermal Field, El Salvador by G. Cuéllar, M. Choussy and D. Escobar gives an example of the influence between the rate of extraction pressure as well as temperature and the rate of reinjection into the reservoir.

The detailed index of the book is worthy to be recognized separately.

Günter Buntebarth

C.N. Garagunis: Hydrogeologische Untersuchungen der Thermal- und Mineralquellen in östlichen Mittelgriechenland. Steirische Beiträge zur Hydrogeologie, 30, 82 S., Graz, 1978. In German, with an English summary. 25 figures, 1 map.

The booklet gives an excellent review the thermal waters of Eastern Mid-Greece, presenting the geological and geophysical works carried out on the area. The thermal water occurrences are concentrated on the environment of the Gulf of Mali, around Thermopylae (= Thermal gate), including the famous spa of Kammena Vourla. This thermal area is characterised by considerable Plio- Pleistocene volcanic activity, by high heat flow (about 100 mW/m²) and lies on the main strike-slip fault which borders the Macedonian and Aegean-Anatolian microplates. The thermal waters are deep-crustal waters of meteoritic origin which came on the surface along faults gravitationally. It is to add however two important facts to this simplified model. (a) During their subsurface migration, the waters communicate with the young volcanic activities of the area of investigation, as demonstrated by the high radioactivity and CO₂, H₂S content of the mineral springs. The high (33–83 °C) temperature of the springs is also originated by volcanic influences; this latter seems to determine the mentioned high heat flow density on the area. (b) Along the coast line of Gulf of Mali, a considerable seawater encroachment was determined into the freshwater, by chemical (sodium, bromium and iodium) analyses. The mean contribution of seawater is of about 25%, for the whole springs. This mixing rate was supported by isotopic (O18) measurements too. – C14 measurements show that the model-age of the spring waters is higher than 15,000 years.

The work can serve as a guideline of methodology, for similar regional studies.

Lajos Stegena