Geothermal geochemistry of selected hot springs from Jiangxi, SE-China

ZHANXUE SUN

East China Institute of Technology, Fuzhou, Jiangxi Province 344000, China (zxsun@ecgi.jx.cn)

Introduction

Jiangxi Province, SE-China, is one of the regions in which hot springs are most widely distributed in China. In the province, 96 hot springs with temperatures ranging from 25 to 88¡æ have been found. Two hot spring areas in the province, the Maanping hot spring area and the Linchuan hot spring area have been selected for this study.

Water chemistry

The waters in the two areas can be classified into three types: 1) Mg-HCO_3 type, including one cold water sample; 2) Ca-HCO_3 type, including most cold springs in the two areas and three hot springs in the Linchuan hot spring area; 3) Na+K-HCO_3 type, the rest of the samples in the two areas, including two hot springs in the Maanping hot spring area. Clearly, the difference in the chemical composition of hot spring water in the two areas is quite significant.

All the data points are plotted in Giggenbach's Na-K-Mg triangular diagram. The diagram shows that all the waters in the two areas are immature ones for which the application of cation geothermometers is not suitable.

Isotope geochemistry of natural waters

In the Linchuan hot spring area, theδD andδ^{18}O values are –38.4 to –52.0‰ and –6.6 to 6.8‰, and in the Maanping hot spring area are –44.1 to –45.4‰ and –6.8 to 7.2‰ respectively. The values are roughly in line with the local meteoric water line$\delta D=8.4\delta^{18}O+11.8$[1], which indicates that the thermal waters are of meteoric origin. No oxygen shift is found showing that either the subsurface temperature of the geothermal reservoirs in the two areas are quite low and the thermal waters belong to low-enthalpy geothermal resources or the water/rock ratio is quite high in the systems.

Subsurface temperature estimation

The subsurface temperatures in the two geothermal systems are estimated to be 72 to 97°C by quartz geothermometer[2] and 102 to 124°C by chalcedony geothermometer[3]. Results of drilling show that the temperature of thermal waters from wells above 1000m depth is not higher than 100°C in the province. So the chalcedony geothermometer temperatures are probably closer to the reservoir temperature than the quartz temperatures.

Acknowledgements

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References

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The past and future geologic history of the carbon cycle

ERIC T. SUNDQUIST

U.S. Geological Survey, 384 Woods Hole Road, Woods Hole, MA 02543 USA; esundqui@usgs.gov

Understanding the present-day carbon cycle has become a matter of international urgency because of concerns about the effects of human activities on atmospheric chemistry and global climate. This public attention has had far-reaching consequences for research on the geologic history of the carbon cycle as well as for studies of its present and future. The rapid pace of scientific discovery demands that studies of the carbon cycle in Earth history not be isolated from the context of current and potential future changes in climate and the carbon cycle.

Four central themes dominate studies of the geologic history of the carbon cycle: (1) Variations in the carbon cycle reflect the influence of different processes over different time scales. (2) The geologic cycling of carbon over all time scales passes through the atmosphere and hydrosphere, and "it is this common course that unites the entire carbon cycle and allows even its most remote constituents to influence our environment and biosphere" (Des Marais, 2001). (3) Changes in the cycling of CO_2 and CH_4 through the atmosphere have been associated with climate change over a broad range of time scales, but the relationship between carbon and climate in Earth history is best described in terms of complex interactive feedbacks rather than simple cause and effect. (4) Relatively abrupt changes appear as conspicuous events in the evolution of the carbon cycle throughout Earth history.

Each of these themes can be related to the understanding of present and potential future impacts of human activities. Model simulations of these impacts extend to geologic time scales and include the influence of "remote constituents" such as carbonate dissolution, rock weathering, and sediment burial. Potential feedbacks between future climate and carbon-cycle change are a topic of intense research and debate. The effects of current human activities on the carbon cycle must be viewed as a geologically abrupt event by any standard.

Studies of the geologic history of the carbon cycle and of present and future carbon-cycle dynamics will be advanced by collaborative approaches to several problems. Geologic records of abrupt events are still extremely sparse, but could provide evidence of past analogs to current interactions. Strategies to monitor the present-day carbon cycle focus on global fluxes, with relatively little attention to particular components or regions that might be most susceptible to abrupt change. New computational approaches are needed to span the broad range of time scales from abrupt events to prolonged preconditions and consequences. Studies of the geologic and modern-day carbon cycle are unified not only by the press of public interest, but also by the challenge of convergent data and modeling needs.

Reference

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