ADVANCES IN STUDIES ON GEOTHERMAL RESOURCES IN CHINA

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ABSTRACT: Based on recent year's advances in geothermal resources studies and explorations in China, this paper reviews the basic distributive characteristics of hot springs in the uplifted area and geothermal water in the Meso-Cenozoic sedimentary basins, suggests that two hydrothermal activity concentrated zones (South Tibet Autonomous Region — West Sichuan Province — West Yunnan Province and coastal area of Southeast China), one large basin (North China Basin) and two smaller basins (Weihe Basin and Leiqiong Basin) are major areas of study and exploration of geothermal resources in China continent, considers that geothermal resources in China have certain potential of exploitation and should be used, but the scale of exploitation seems to be limited, they cannot occupy an important position in energy supply and can only be regarded as a supplementary energy source.

KEY WORDS: geothermal resources, potential of exploitation, Review, China.

1. GEOTHERMAL RESOURCE REGIONS WITH NATURAL MANIFESTATIONS IN TECTONIC UPLIFTS

This type of geothermal resource regions is featured by hot springs and other manifestations which may appear in the form of single-spring or group-spring. Various types of manifestations may coexist in a hydrothermal area. The manifestations in China are dominantly hot springs whose temperatures are less than 80°C. The strong hydrothermal activities, such as boiling springs, boiling-gushing springs, exhalation pores, steaming ground, geysers, hydrothermal explosions and so on whose temperatures are up to or higher than their local boiling points, are only seen in some areas in the Qinghai—Xizang (Tibet) Plateau, West Yunnan Province, West Sichuan Province and Taiwan Province.

1. Geographical Distribution of Hydrothermal Areas and Heat Discharge from Hot Springs
According to updated statistics, 2,200 hot springs with temperatures greater than or equal to 25°C appear in China, of which 859 with 25–40°C, 807 with 40–60°C, 398 with 60–80°C, and 136 with > 80°C, respectively occupying 39%, 37%, 18%, and 6% of the total hot springs in the whole nation. The total heat quantity discharge from hot springs is 101.9 PJ/a, the heat quantities of above four temperature grades are 31.98, 21.49, 28.86, and 19.57 PJ/a, occupying 32%, 21%, 28% and 19% of the total amount respectively. The annual quantity of heat brought out by the hot springs in China can be converted into standard coal of the 3.54 million tons.

According to statistics on hot springs distribution in executive regions, with exception of Heilongjiang Province and The Ningxia Hui Autonomous Region without hot springs of temperature higher than 25°C, and Shanghai and Tianjin cities without hot springs, there are different numbers of hot springs in other provinces and Beijing City. The provinces or regions with most spring–number in China are Yunnan (603), Tibet (283), Guangdong (275), Sichuan (220) and Fujian (174), the number of springs in those five provinces is approximately 70% of that of China. Five provinces, with spring densities greater than 10/10,000 km², are respectively Taiwan (19.2), Yunnan (15.9), Guangdong (14.3), Fujian (14.1), and Hainan (10). The 10 provinces with the springs exothermic quantity greater than 3 PJ/a are consequently Tibet (36.4), Yunnan (19.30), Shaanxi (7.62), Sichuan (5.53), Guangdong (5.01), Fujian (3.98), Shanxi (7.26), Taiwan (3.37), Hubei (3.30) and Hunan (3.14). Those ten provinces possess 89% of the total exothermic quantity of the whole nation. It is worth to mention that the cases of Shaanxi and Shanxi provinces are extremely particular, although there are only 13 and 6 springs, the exothermic quantities rank the 3rd and 7th respectively. This fact results from karst springs of big water discharge (the biggest, 1–2 m³/s, water temperature, 25–30°C) distributed along a northern boundary of Weihe Basin, and boundaries of Datong Basin and Linfen Basin.

2. Major Concentrated Zones of Hydrothermal Activities

The following prospective zones of geothermal resources are identified according to distribution characteristics of hot springs and geothermo–geological backgrounds.

2.1 Concentrated zone of hydrothermal activities along South Tibet–West Sichuan–West Yunnan

It consists of an important part of the Mediterranean geothermal zone, one of the global geothermal zones. Tong Wei et al. calls it Himalayan geothermal zone. There are 772 springs in this zone, approximately 33% of the total number of the nation, among them, 221 with temperature of 25–40°C, 282 of 40–60°C, 139 of 60–80°C and 80 of > 80°C. The exothermic quantities of four temperature grades are 3.92, 8.44, 6.28, and 14.98 PJ/a respectively, and totally 33.62 PJ/a, they also share 33% of the total amount of the whole nation. Of the springs of temperature higher than 80°C, 41 occur in south Tibet, at least 5 in