CHARACTERISTICS OF PERIGLACIAL GEOMORPHOLOGY IN THE SOURCE AREA OF THE HUANGHE RIVER

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ABSTRACT: There widely occur stretches of permafrost at more than 3,800–4,200 meters above sea level in the source area of the Huanghe (Yellow) River. The periglacial geomorphology develops quite well, including frozen disintegration geomorphology, freezing and thawing geomorphology in cold environments, periglacial dune, buried ices and fossil periglacial phenomena. In light of the relation between stratigraphy and periglacial phenomena, three periglacial periods can be divided, which are the Middle Pleistocene periglacial period, the Late Pleistocene periglacial period and modern periglacial period.

KEY WORDS: source area of the Huanghe River, periglacial geomorphology, periglacial period

I. OUTLINE OF GEOGRAPHIC AND GEOLOGIC FEATURES OF THE STUDIED AREA

The source area of the Huanghe River lies in the northeastern part of the Qinghai–Xizang (Tibet) Plateau and Qinghai Province. Its geographical position is between 33° 50' –35° 40' N and 97° 00' –99° 40' E. With Bayan Har Mountain in the south, the Buqin Mountain and Ngola Mountain in the north, the western bank of Gyaring Lake in the west and the A'nyemaqen Mountain in the east, the total area is about 28,000 km².

The Huanghe River flows into Gyaring Lake and Ngoring Lake from the west, after bypassing Madoi County it flows out of the studied area in the southeastern direction.
Along the whole distance of 300 km, it converges several tributaries such as the Doqu, Lunagqu and Heihe rivers etc. At the end of the studied area, it has a flow capacity of 100 m³/s. Gyaring Lake and Ngoring Lake are regarded as the two bright pearls in the upper reaches of the Huanghe River, playing an significant role of regulating the water resource in the source area of the Huanghe River. Based on exploration, the area of Gyaring Lake is 526.1 km². Its distance from the east to the west is 35 km and that from the south to the north is 21.6 km. The maximum water depth is 13.1 m and the average is 8.9 m. The area of Ngoring Lake is 610.7 km². Its distance from the south to the north is 32.3 km and that from the east to the west is 31.6 km, like a shape of triangle. The maximum water depth is 30.7 m and the average is 17.6 m.

The tectonic system of the region is part of Qinghai, Xizang and Yunnan zeta-type head periphery. The stratum is mainly composed of sandstone slate and limestone layers of the Permian and Triassic periods. The Quaternary stratum is mainly composed of the moraine and outwash of the Middle Pleistocene and the Early Pleistocene epoch, besides, there are also some lacustrine strata of the Late Pleistocene epoch and some alluvial, pluvial, aeolian and bog deposition etc. of the Holocene epoch.

The average elevation of the area is above 4,100 m and the highest is 5,262 m. It is characterized by an extremely cold and dry climate with much wind and snow, which is a typical continental plateau climate. The annual mean temperature is \(-4.1°C\); the annual precipitation is 303.9 mm; the annual evaporation capacity is 1,374 mm; and the absolute humidity is 3.2 mb.

There widely occur high elevation type and continuous stretches of permafrost, which accounts for more than 88 percent of the total area. Influenced by the physical geographical and climatic conditions, the distribution of permafrost has a prominent three-dimentional zonality (latitudinal, longitudinal and vertical). In the area of the Ngola Mountain, permafrost exists at the elevation of 3,861 m (shady slope) to 4,100 m (shining slope) and increases towards the south to 4,100–4,442 m at the Bayan Har Mountain and its south-facing slope. The former permafrost is 51.1–71.53 m in thickness and the latter is 7.5–29.5 m by drilling exploration. In the hinterland of the Bayan Har Mountain the permafrost thickness is estimated to be over 50 m and the active layer is 0.6–1.6 m deep. There are taliks in the region of Gyaring Lake, Ngoring Lake and the major flowing area of the Huanghe River. The structural taliks exist along the tectonic fault at Wenquan Town in the Erla Mountain.

II. FEATURES OF PERIGLACIAL GEOMORPHOLOGY

Periglacial geomorphy is the result of integrated action by lots of physical factors. In the studied area there are many kinds of well developed periglacial geomorphic phenomena that their occurring and developing are carried out by repeated freezing and thawing of the