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Research progress in China's Lop Nur

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ABSTRACT

China's Lop Nur is one of the world's largest playas, and is located in the driest part of Central Asia. Scientific explorations by Chinese and foreign researchers have been continuously conducted there since the mid- to late 1800 s, and much progress has been made, but many issues remain hotly debated. Particularly intense debate focuses on the formation, environmental evolution, drying date of the Lop Nur lake, and cause of the helical salt crusts recently revealed by remote-sensing images. In this paper, we review the status of this research to provide insights that can inform studies in other arid zones that resemble the Lop Nur. The Lop Nur depression is a secondary unit of the Tarim Block, controlled by faults and fractures formed by the Himalayan orogeny, but various competing explanations have been proposed for how these geological structures gave rise to the depression. The depression's formation date also remains unclear. Several boreholes have been created to reconstruct the environmental evolution at different time scales since the Quaternary, and deposition rates of lake sediments, especially since the Late Pleistocene, have averaged less than 1 mm annually. The drying date of the Lop Nur lake is also debated. The helical salt crust structures appear to have formed as the lake shrank, but how and when they formed is unclear. Huge potash reserves have been found, and large-scale potash fertilizer production has begun, but the origin of these deposits is debated. Understanding the factors causing environmental evolution in this region is a central issue that will help us to clarify these and other debated issues.

Contents

1. Introduction

China's Lop Nur depression is one of the world's largest playas, covering an area of about 20,000 km^2. It is located in northwestern China between latitudes 39°N and 41°N, and between longitudes 88°E and 92°E (GGXCI, 1978) (Fig. 1). It has long been considered a place of mystery, and has therefore experienced continuous exploration and study by researchers from around the world since the mid-

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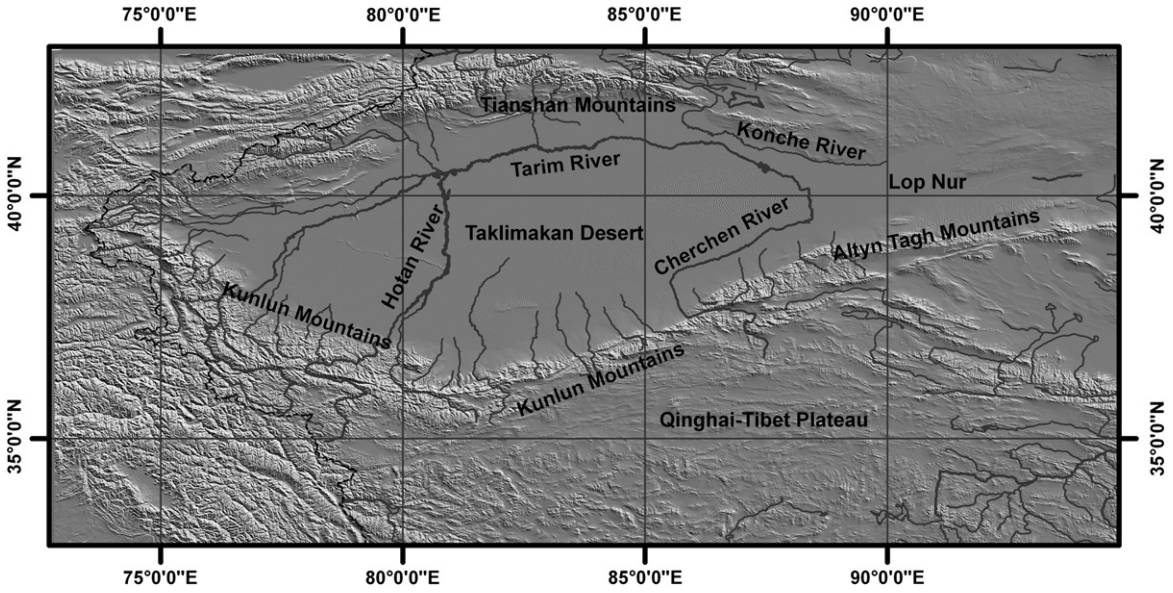

Fig. 1. Geographical location of China's Lop Nur depression.

19th century (quoted from Xia et al., 2007). Its mystical qualities reached a peak in the 1980s, when satellite images revealed the depression's helical salt crust structure, a structure like a human ear, and which has therefore been named the "Great Ear" (Fig. 2), for the first time. However, progress in studies of the Lop Nur remained slow until the 1990s due to its difficult environment and remote location, despite growing interest in the area. The situation has improved greatly in the last two decades thanks to revolutionary advances in research methods and tools such as remote sensing, GPS surveys, and modern transportation and communication techniques.

Consequently, the Lop Nur has received unprecedentedly intense investigation for the last two decades. The Lop Nur's unique significance from the perspectives of science, resource development, and environmental protection is increasingly being recognized. The following aspects attract researchers to study the Lop Nur: (1) It is the driest area in Central Asia, with annual precipitation of less than 20 mm (Li, 1991), also making it one of the most arid regions in the world. Its environmental evolution, especially during the Quaternary, resembles in miniature the evolution of arid environments elsewhere in the world. Many questions concerning environmental evolution in arid regions during the Quaternary may be answered by research in the Lop Nur (Xia et al., 2007). (2) The Lop Nur is the lowest place east of the Tarim Basin, and is surrounded by actively uplifted mountains such as the Kunlun Mountains and the Altyn Tagh Mountains to the south (both are parts of the Qinghai–Tibetan Plateau) and the Tienshan Mountains to the north. As a result, the Lop Nur is at the convergence of sediments and salts from throughout the Tarim Basin, and therefore bears rich information about the environmental

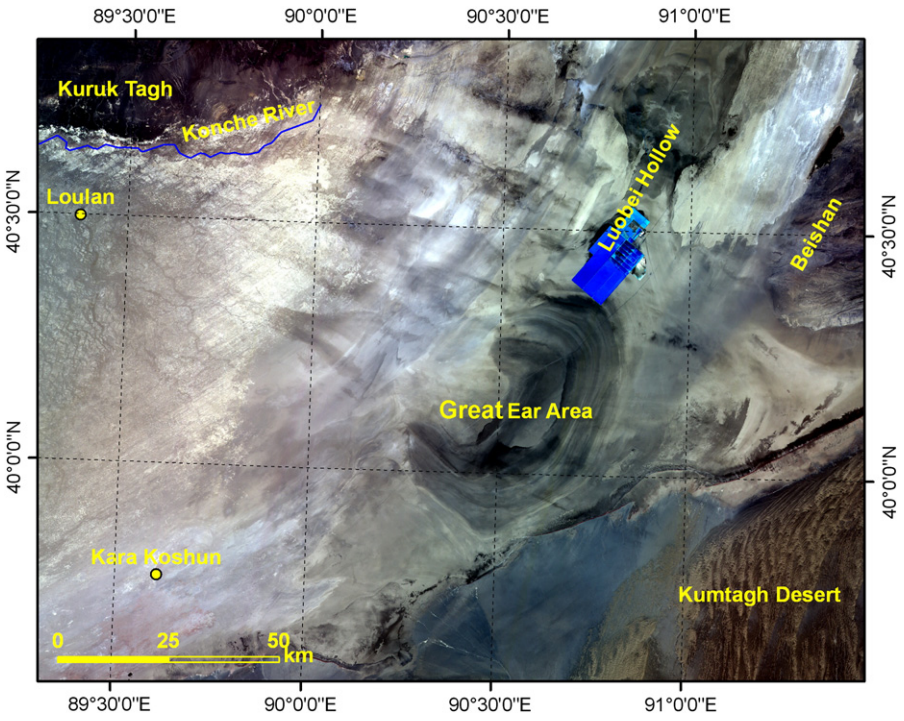

Fig. 2. Satellite image showing the helix-like structures of the Lop Nur.