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Enclosed Extent of the Saline Water and its Constraints on the Sedimentary and Salt Forming Characteristics: A Case Study of the Paleogene Playas in Hoh Xil Basin

GONG Daxing^{1,2}, YI Haisheng², ZHOU Jiayun¹, WU ChiHua² and XIA Guoqing²

1. *Institute of Multipurpose Utilization of Mineral Resources, Chinese Academy of Geological Sciences, Chengdu, Sichuan 610041, China*

2 *Chengdu University of Technology, Chengdu, Sichuan 610500, China*

1 Introduction

There is a long period of hot, arid climates in the Jurassic-Neogene, in the eastern of the Neo-Tethys where has been called Western Yunnan—Qiangtang tectonic belt (Zheng et al., 2010). Especially in the Paleogene, under the control of the planetary winds and the north subtropical high pressure belts, a ribbon arid, semi-arid climate zone was throughout this tectonic belt, and get further cold and dry with the formation of polar ice sheets. From this, a wide range of continental red clastic rocks and gypsum, salt rocks had been developed in the Paleogene Hoh Xil, which with great thickness and multilayers sedimentary system. A lot of preserved salt domes can be found from the outcrops. It's a typical continental salt lake (playa) depositional environment (Liu and Wang, 2001; Sun and Wang, 2005; Gao et al., 2006; Yi et al., 2007; Yin et al., 2007; Miao et al., 2008; Xu et al., 2009).

The sedimentary evolution and salt forming mode of the playa are controlled by climate conditions, groundwater and the size and enclosed extent of the playa system itself. When the climate, replenishment and the scale of the basins are roughly the same, the combination of the lithofacies during the deposition process is mainly controlled by the degree of the openness extent of the saline water. In accordance with the openness or enclosed extent, playa can be divided into two types: enclosed, semi-enclosed playa and opened playa (Institute of Geology, 1979). There are obvious difference in their salt deposited model, lithologic character and lithofacies sequence. Take two sub-salt basins in Hoh Xil region for example, enclosed extent of the saline water in the playa

and its constraints on the sedimentary and salt forming characteristics have been discusses in this paper.

2 Sedimentary and Salt Forming Characteristics of the Different Playas in Hoh Xil

Taking the Hoh Xil-Jingshajiang suture belt as the center, the Hoh Xil basin can be divided into two small Cenozoic sedimentary sub-basins. The southern is Tuotuohe basin(TTH basin), which is approximately 15317km²(Zhang and Zhen, 1994), mainly located on the south east coast of the Tuotuo river, extend along the east-west direction, lenticular, paralleled with the regional tectonic line. Bounded by the Rier Lama mountain, The Northern is Cuorendejia basin(CRDJ basin), which is located in the area of Cuodarima river, Cuorendejia river and Lemaqu river, east-west trend, 45600km²(National Petroleum Corporation in China, 1997.). There are a lot of salt rocks and evaporates deposits distribute in the stratum of Oligocene and Miocene in both of two basins, which was called Yaxicuo formation(Oligocene) and Wudaoliang formation(Miocene), in the north and south edges of the basins, a small amount of banded Fenghoushan formation(Paleocene-Eocene) outcrops can be found.

The middle and upper layers of the Yaxicuo group are the main salt-bearing horizon in this region. At least two sets of salt-bearing series can be identified from the two basins, with a clear sign of continuous deposited, contiguous outputted salt layers on the ground. In the south, TTH basin, yellow-green is the dominant hue of the salt-bearing series, sandwiched with purple, gray-green and gray-black rock stratum, mostly included by marl and

* Corresponding author. E-mail: gongdaxing@gmail.com

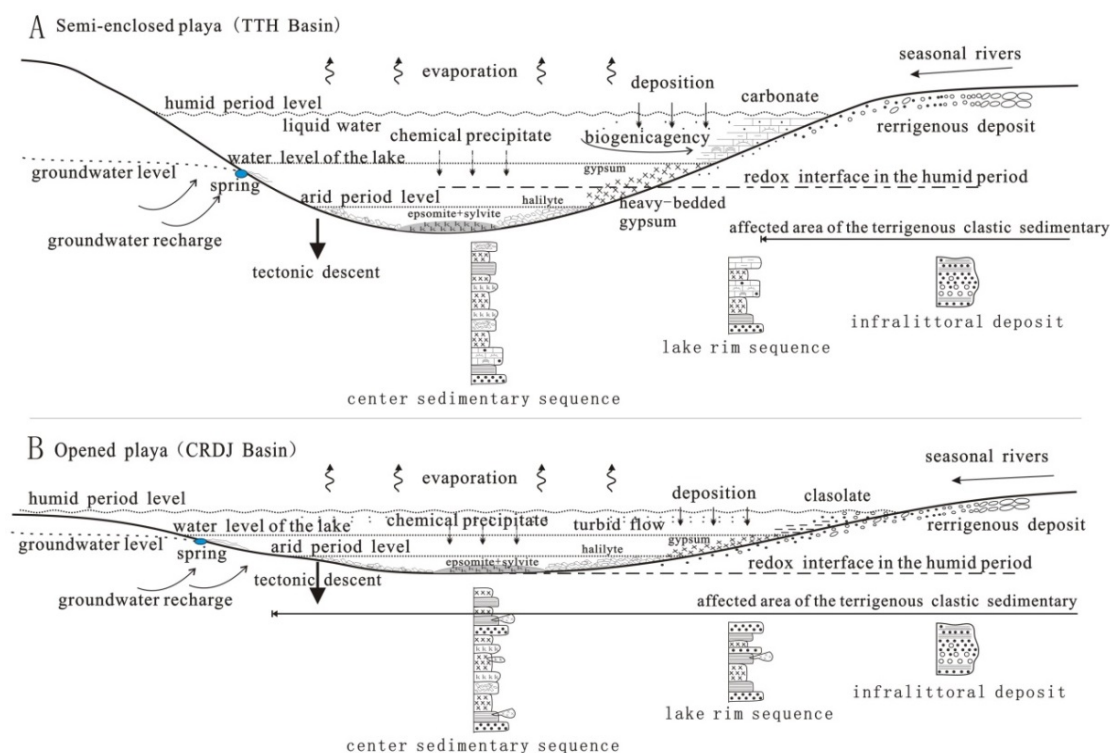


Fig. 1. Sedimentary and salt-forming model of the different playas in Hoh Xil.

mudstone, entrainment with a lot of gypsum and a litter of sandstone, siltstone, according to the section measurement, the thickness of the series is greater than 1100m. In CRDJ basin, dominant hue of the salt-bearing series is crimson, without variegated rocks. The lithology are combined by crimson mudstone, siltstone and fine sandstone, thickness reached 1400m. Not like the south, there is no carbonate in north. This shows that both of the two salt-bearing series are formed in ancient playas, but had different deposit modes.

The ancient TTH basin belonged to enclosed-semi enclosed playa system, especially in the area from the Bucha lake to the north shore of Tongtian river, the ancient lake was relatively deep, far away from the river estuary. In the periods of drought, when the seasonal rivers supply reduction, under the control of evaporation, the saline water continuous desiccated and concentrated. The brine appeared chemical precipitation, the sulphate and halite followed precipitated, even outputted the epsomite and sylvite in some area, and a lot of thick gypsum layers usually formed in the center of the playa before the salt minerals. In the relatively wet period, because of the center of the main playa was far away from the river estuary, the impact of the seasonal rivers was a small range. Most of the detritus in the floods could not reach the playa center, only deposited in the salt flat or

salina. The water was relatively clean, microbes flourish, much of carbonates formed in this time. In the very center of the lake, hydrodynamic condition weak, belong to the anoxic reduction environment. A small amount of fine suspended sediments formed as mudstone, or calcareous shale, marl if there had biological effect (Fig.1A). Because of the relatively deep basin, unlike the north, the sediments in TTH basin was controlled and influenced by the interface of reduction oxidation in the wet period, so, two salt-bearing series has different color and lithology as well.

The ancient TTH basin belonged to opened playa system. Its salt-bearing series are characterized by lack of carbonate, but rich red crimson rocks. As the playa is shallow and flat, the playa was affected by seasonal rivers also in the drought time. Therefore, in the deposition process, a lot of terrigenous clastic would participate in the gypsum-salt layers. On the surface of the gypsum mudstone and siltstone, we could see many of ripple in shallow water, scolite and other shallow sedimentary structures. Because of this topography of the playa, the area of brine lakes would be great wider, the same as its salification domain. However, the leaching of the precipitated salts will be faster in the vast expanse of salina coexists. In the wet period, the entire playa would be affected by the rivers, the water turbid, mainly

sediments was clastic rocks, no carbonatite developed. The involving of the surface water dissolved the salts which were formed earlier, meanwhile, rapid accumulation of terrigenous material will effectively save the salt deposits. The degree of the preservation and leaching would be different because of the distinct topography, water level and deposition rate. Ultimately, the preserved gypsum-salt layers always showing the shape like thin-bedded, lenticular and hummocky in the CRDJ basin (Fig. 1B).

Key words: Enclosed extent, Paleogene playas, sedimentary and salt forming characteristics, Hoh Xil Basin

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