Impact of provenance and diagenesis on sandstone reservoir quality of the Middle Permian in northern Ordos basin, Chian

JING-LAN LUO[1]*, XIN-SHAN WEI[2] AND XIN-SHE LIU[2]

[1]State Key Laboratory of Continental Dynamics, Northwest University, Xi'an, 710069, China (*correspondence: jlluo@nwu.edu.cn)

[2]Research Institute of Exploration and Development, Changqing Oil Field, Petrochina, Xi'an, 710021, China

The rock types and mineral components of the Permian He 8 sandstones in the northern Ordos basin is controlled by provenance and diagenesis, based on study of LA-ICPMS dating for detrital zircons, mineral assemblages of sandstones, diagenesis and diagenetic evolution of mineral components and pore structures. Parent rocks determined types, component maturity, primary skeleton of sandstones, influenced diagenetic paths, authigenic minerals in sandstones, which resulted in diversity of pores and pore throats, thus varied reservoir qualities. The quartzarenite mainly located in the west area of the Ordos basin derived from the Khondalite (1.8-2.3Ga) and the TTG gneiss, granulites and granites (2.4-2.6Ga) outcropped to the north and northwest margin of the Ordos basin. In addition to the above parent rocks, lithicarenite distributed in the east part is mainly derived from the Archean metamorphic rocks (>2.6Ga) and the Devonian-Carbonniferous granite and volcanic materials (400-300Ma). While the provenance of lithic quartzarenite predominated in the middle part is from the both sources. Average porosity lost caused by compaction for the quartzarenite, lithicarenite and lithic quartzarenite is 17.2%, 18.5% and 18.3%, respectively, and caused by cementation is 15.0%, 14.7% and 15.8%, respectively. Three types of the sandstone are of different quality due to diversities in components and cements. The quartzarenite is the best gas-bearing reservoir which is of the highest primary porosity (av. 35.1%) and excellent reservoir quality with av. porosity and permeability of 9.7% and 2.7mD, respectively. The lithic quatzarenite is in the second place with av. primary porosity of 34.2%, av. porosity and permeability of 10.9% and 0.87mD, respectively. The lithicarenite is unfavorable reservoir which is of relatively low primary porosity (av. 33.6%) and inferior quality with av. porosity and permeability of 9.6% and 0.5mD, respectively.

This study is supported by the National Natural Science Foundation of China (Grant No. 40872083).

The scavenging behavior of ^{230}Th and ^{231}Pa in the ocean: A model prediction

SHANGDE LUO

Department of Earth Sciences, National Cheng-Kung University, Tainan, 701, Taiwan, ROC (sluo@mail.ncku.edu.tw)

^{230}Th and ^{231}Pa are two important radionuclides in the uranium decay series which have been widely used to undertsand the past and present oceanic processes. To quantitatively constrain the oceanic behavior of these two radionuclides, a model analysis is conducted based on the observational data on particle-solution distribution coefficient (K_d) of ^{230}Th and ^{231}Pa collected from various parts of the world oceans. Our analysis indicates that it is the nature of particles which scavenge thorium and protactinium from seawater, rather than ocean circulation, that plays an important role in determining the ^{231}Pa/^{230}Th ratio in ocean sediments. The nature of particles affects the scavenging of ^{230}Th and ^{231}Pa by exerting an important control on the particle-solution distribution of ^{230}Th and ^{231}Pa in the ocean. This study shows that while ocean circulations are quite different in the world oceans, a simple scavenging model can be established to characterize the behavior of these radionuclides based solely on particle compositions.

It is estimated based on the data from Arabian Sea that K_d (Th) in lithogenics is (2.2–3.0) ×10^7 g/g, about one order of magnitude higher than that in both carbonate and organics or two orders of magnitude higher than in opal, suggesting that the lithogenics dominates the scavenging of ^{230}Th in the Arabian Sea. In contrast, K_d (Pa) is estimated to be on the order of ~10^6 g/g in lithogenics, comparable to that in opal and organics but about one order of magnitude higher than in carbonate. The results imply that the fractionation between Th and Pa is controlled mainly by the lithogenic-to-opal ratio in marine particulates, consistent with the results from the open equatorial Pacific and Southern Oceans even though both K_d (Pa) and K_d (Th) of lithogenics in the Arabian Sea are about one order of magnitude lower. From this study, we also found that the affinity of carbonate for Th and opal for Pa is significantly higher in the deep ocean (at ~3000 m) than in the thermocline (~500 to 1000 m), opposed to that of lithogenics for Th and Pa showing significant decreases with the water depth from < 1000 m to ~3000 m. It appears that changes of particle's properties during its transit from the surface to deep oceans may exert an important control on the scavenging and fractionation of radionuclides in the ocean.