The composition and texture constrains on micro-porosities of dolomite reservoirs,Tarim Basin, NW China

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Lower Paleozoic carbonates act as high quality reservoir rocks in the Tarim Basin, NW China. As they are mostly deeply buried up to ca. 5000 m, a long and complex diagenetic history must have happened. Consequently, the primary pore spaces of such carbonates were generally disappeared due to compaction and cementation. Thus, secondary porosities mainly caused by dissolution are important for petroleum accumulation as suggested by some authors. According to this research, the vuggy porosity is mainly resulted in diverse-dissolution between calcite and dolomite during burial. And the composition and texture of the dolomite have effective constrains on this process despite of the influence of geofluids.

Based on the observation of cores and the analysis of logging data, the dissolved micro-porosities do not show an uniform occurrence. Specifically, it is well developed in the transition interval from limestone to dolomites of Lower Ordovician Yingshan Formation, where limestone, calcareous dolomite and dolomite are inter-bedded. It is common to observe intergrowth of the calcites and dolomite minerals, and the residue of calcite dissolution is obvious but the dolomites usually remain good rhomb crystals, which indicates that the calcite is much easier to be dissolved during burial than dolomite. And the dolomites act as framework to support the pores created by the calcite dissolution. Therefore, the composition of the carbonates has important influence on the formation of the porosities, and the calcareous dolomite could be good carbonate reservoir in the basin.

However, not all the calcareous dolomite could produce high porosity and permeability, and the carbonate texture must be also taken into account. By EPMA analysis and observation, the calcite minerals show different occurrences, some of which occur in the dolomite intercrystalline pores, and the others are scattered in the dolomite crystals. Then, the dolomites can be subdivided into three groups: intercrystalline filling type (type Ⅰ), intracrystalline filling type (type Ⅱ) and intra-and-intercrystalline filling type (type Ⅲ). The calcite of type Ⅰ is much easier to be dissolved than that scattered in the dolomite. It is suggested that the fluids could not easily dissolve the dolomite crystals so as to dissolve the calcite in them. As a result, the Type Ⅰ and type Ⅲ dolomites could become good reservoirs in this basin.

Rodinia mantle plume: New evidence from the ~825Ma komatiitic basalts in South China

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Mantle plume or superplume activities have repeatedly been invoked as a cause for the breakup of the Neoproterozoic supercontinent Rodinia, with supportive evidence including radiating dyke swarms, globally-synchronous anorogenic igneous activities, large-scale lithospheric doming and unroofing, and geochemical signatures similar to recent plume-related magmatism. However, identification of the Precambrian mantle plumes has been difficult owing to modifications by younger geological processes, and thus the lack of more diagnostic plume-induced petrological records(high-temperature melts), such as picrites and/or komatiites has been a major argument against the Neoproterozoic South China plume model.

We present here geochronological and geochemical data from a komatiitic basalt suite of pillowed lavas in central South China. SHRIMP U-Pb dating of zircons from an evolved member of andesitic composition within this suite indicates that these lavas were erupted at 823 ± 6 Ma. All but a few highly-evolved, crust-contaminated basaltic rocks are characteristically high in MgO (10.2-17.5 %), Ni (183-661 ppm) and Cr (677-1672 ppm), but low in TiO_2 (0.5-0.7%), Al_2O_3 (10.6-12.7%) and FeO^T (7.4-10.5%). By removing the effect of ~5% olivine crystallization, the Yiyang primary magma has typical komatiitic compositions with MgO ≈ 20%, FeO^T ≈ 11%, SiO_2 ≈ 47%, TiO_2 ≈ 0.48%, Al_2O_3 ≈ 10%, Ni ≈ 860 ppm and Cr ≈ 1780 ppm. Such a high MgO content in the primary melts implies a melt temperature of >1500°C, suggesting that the Yiyang komatiitic basalts should have been generated by melting of an anomalously hot mantle source with potential temperature (T_p) being 260 ± 50°C higher than the ambient MORB-source mantle, similar to that of modern mantle plumes.

Our identification of the 823±6 Ma Yiyang komatiitic basalts, generated by ~825 Ma mantle plume, provides for the first solid petrological evidence to constrain the controvery of the tectonic provenance of Neoproterozoic volcanism and sedimentation within the South China Block (the combined Yangtze and Cathaysian Cratons) with direct bearing on Rodinia reconstruction models.