Features and significance of boiling oil inclusion in Ordos Basin, China

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Ordos Basin, the second largest oil/gas production basin in China, is located in center of north China. Upper Triassic Yanchang Formation, the most important commercial oil-producing bed, consisted of fine grain calcareous sandstone with low-permeability [1]. Drilling cores show that upright micro-fractures, cut through oil sandstone beds, were frequently filled by small calcite veins with several milimiters wide. Microscope observation indicates that large numbers of boiling oil inclusions contained in carbonate cements and calcite veins of sandstone. Oil inclusions, with bright yellow fluorescence under reflected blue light, occurred along growth zones or as clusters in the host calcite crystals (Fig.1-1). Two-phase inclusion with liquid (L) and vapour (V) (Fig.1 -2, 3) and three-phase inclusion with liquid (L), vapour (V) and small dots of black solid bitumen (Fig.1-4) were coeval and they concentrated in growth zone of calcite crystal (Fig.1-1). Gas/liquid ratio of oil inclusion was highly variable from about 5%(Fig.1-2) to nearly 70% (Fig.1-3). Homogenization temperature of all kinds of inclusion narrowed in a range from 74 to 117℃ with the peak of 101 ℃.

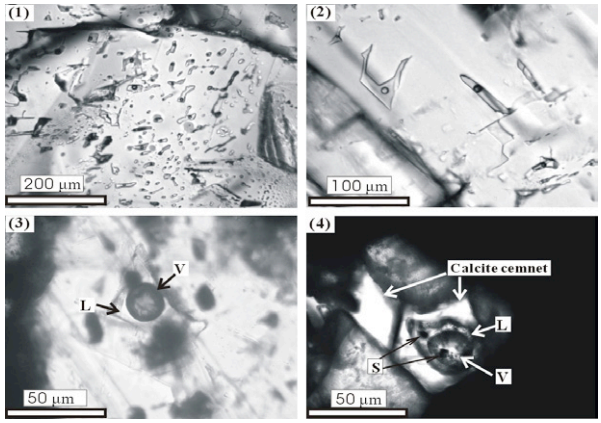

Figure 1: Photomicrograph of boiling oil inclusions.

Intergrowth between oil inclusions of different types and texture of calcite indicates that gas-rich and liquid-rich oil inclusions appeared to have been trapped simultaneously. Coexisting of oil inclusions of different types strongly suggests that oil boiling occurred during the period of calcite cementating of sandstone and calcite vein filling. Features of oil inclusions represent a case of heterogeneous migrating and trapping of liquid oil during boiling process because of cracking of sandstone due to over presure.

[1] Yongtai Y. *et al*. (2005) *AAPG Bull*. **89**, 255–269.

Partial melting during continental subduction-zone metamorphism: Evidence from multiphase solid inclusions within minerals of UHP felsic vein and host eclogite in the Dabie orogen

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Multiphase solid (MS) inclusions, with regular shapes and radial fractures, are found within metamorphic minerals such as garnet, kyanite and epidote in felsic vein and host eclogite at Sanzusi in the Dabie orogen. Coesite pseudomorphs are found in epidote of both felsic vein and eclogite, indicating significant fluid activity under UHP metamorphic conditions. The common paragenesis of the MS inclusions is quartz + K-feldspar ± silicate, suggesting that they are daughter minerals precipitated from hydrous silicate melts. Because of their constant volume ratios, a constraint is placed on the chemical composition of metamorphic melt: 0.12wt.% Na_2O, 7.49wt.% K_2O, 0.34wt.% FeO, 0.07wt.% MgO, 0.10wt.% CaO, 7.84wt.% Al_2O_3, 0.24wt.% TiO_2, 83.74wt.% SiO_2 and 0.05wt.% NiO. Such a composition suggests that the MS inclusions were crystallized from ultrapotassic and silica-oversaturated melts, providing an insight into the material transfer within the deeply subducted continental crust.

The occurrence of felsic MS inclusions in the UHP eclogite-facies minerals demonstrates that hydrous melts are rich in K_2O and SiO_2. They were probably produced by partial melting of the eclogite itself due to the dehydration reaction of phengite. This process may take place during the 'hot' exhumation at HP eclogite-facie subsequent to the peak UHP metamorphism. Although the chemical composition and paragenesis of these MS inclusions may be partially reset during amphibolite-facies retrogression, they are still an effective tool to investigate the nature and composition of metamorphic melt in the continental subduction zone. The existence of hydrous melts in the UHP metamorphic minerals is clearly evidence for partial melting of UHP rocks at the deep subduction zone. This would greatly influence the rheology of deeply subducted continental crust and thus contribute to the rapid exhumation of the UHP slab. It also has bearing on element mobility in association with fluid/melt flow during the exhumation.