

Fluid inclusions petrography in “beefs” and their implications

MIAO WANG^{1*}, YONG CHEN¹, GUOQI SONG³

¹School of Geosciences, China University of Petroleum,
Qingdao, Shandong, 266580, China (*correspondance:
fiwater@sina.com)

²Shengli Oilfield Company, SINOPEC, Dongying, Shandong,
257000, China

Beef refers to the bedding-parallel fibrous calcite vein in low mature laminated source rocks of the Eocene Dongying Depression. Primary hydrocarbon inclusion (HI) and aqueous inclusion (AI) are both present in beefs. The presence of primary hydrocarbon inclusions indicates that vein formation was coeval with migration of hydrocarbons. HIs are two-phases (oil+gas) and occur either within individual fibrous calcite grains or between two adjacent fibres. Oil inclusion assemblages (OIA) are oriented parallel to the crystallographic preferred orientation of fibrous calcites, as are the long axes of elongate, individual inclusions within an assemblage. The hydrocarbon liquid shows various UV-fluorescence colors (brownish, yellow, yellow-green, green), indicating different composition of oil from less mature to relatively high maturity. The coexistence of different fluorescence colors (chemical compositions) of OIAs and the same occurrence of different OIAs in one beef suggest fractionation processes of relatively immature liquid hydrocarbons took place before the trapping.

In addition, many bitumen-bearing oil inclusions occur in the fibrous calcite veins, each containing either the three-phase assemblage bitumen-oil-vapor or the two-phase assemblage bitumen-oil. These inclusions are characterized by black solid bitumen which coats the wall of the inclusions, as well as containing liquid hydrocarbon showing brownish yellow to green fluorescence colors. The bitumen filling degrees are variable within any given OIA. Consequently, we surmise that immiscibility and heterogeneous trapping of liquid hydrocarbon, bitumen and aqueous solution during the fibrous calcite growth are the best explanation for these features. As for the bitumen, one possible source may be from the migration and fractionation of oil, but it is more likely to be a primary product of hydrocarbon generation in these early, low maturity source rocks.

The hydrocarbon inclusions abundance is much higher than aqueous inclusions. It may be caused by differences of oil/water wettability on calcite and hydrocarbon fluids ingress priority to the horizontal fracture. In other words, before the calcite precipitation, the hydrocarbon fluids have already occupied the fracture for horizontal migration.