Secondary biogenic gas formation and accumulation: A case study from Baise Basin, Southern China

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Recent studies based on coal-bed gas suggested secondary biogenic gas occurring extensively. In addition, secondary biogenic gas contributes many independent gas reserviors. Baise Basin is a prolific region with ten secondary biogenic gas fields.

Isotopic data of those gases have $\delta^{13}C_{CH4}$ value ranging from -53.71‰ to -74.6‰ (VPDB) and δD_{CH4} from -218‰ to -245.8‰. Most values of $\delta^{13}C_{C2H6}$ range from -42.4‰ to -64.5‰. Gases contain 0~20% ethane, propane, butane, and pentane. A lot of them contain up to 5% C_{2+}, more than typical biogenic gas. These data suggest that gases should be mixtures of thermogenic gases with bacterial gases generated by bacterial reduction of CO_2.

The co-producing formation waters are all freshwaters, with a relative low salinity from 1430 to 4333mg/l and the majority less than 3000mg/l. Formation waters are $NaHCO_3$ type with the ratio of HCO_3^-/Cl^- higher than 1.0. The high alkalinityies and fresh are interpreted to be related to *in situ* CO_2 generation through anaerobic methanogenesis in response to freshwater invasion [1, 2]. Low TDS freshwater easily invaded from the boundary of the basin, structural high, and fracture belt. Here, almost all the biogenic gas fields lie in freshwater invasion zone.

Baise basin is a complex multicycle basin with the remnant Tertiary superimposed on the metasediment of Triassic. About 4500 m thick Miocene containing coal and organic rich mudstone deposited. Since the 10 Ma, the basin uplifted, 800~1400 m deposits were eroded away. Exactly from then, freshwater invaded, microbial were stimulated and biogenic gas regenerated and accumulated.

[1] Carothers & Kharaka (1980) *GCA* **44**, 323–334 [2] McIntosh *et al*. (2004) *GSA* **116**, 743–759.

Fluid inclusion study of Furong tin Deposit, Hunan Province, China

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The Furong deposit is a newly-found giant tin poly-metallic deposit in southern Hunan province, China. Tin mineralized bodies mainly occur in the endo- and exo-contact zones of the southern part of the Qitianling granite intrusion, which has been evidenced to be of A-type granite. This paper presents the fluid inclusion data of the ores from the deposit. Four types of fluid inclusions have been observed, namely aqueous two-phase inclusions, CO_2-bearing inclusions, gas-rich inclusions and daughter mineral-bearing inclusions. Homogenization temperatures of fluid inclusions in the ores range from 250 to 450°C. The ore-forming fluids have the composition of $CaCl_2$ ($MgCl_2$)-NaCl-KCl-H_2O system with high salinity (32.2 ~ 50.6 wt%NaCl eq.) and CO_2-CH_4-NaCl-H_2O system with low salinity (0.2 ~ 12.4 wt%NaCl eq.). The coexisting of daughter mineral-bearing inclusions and CO_2-rich inclusions has been observed in the same gangue mineral associated with ores and the microthermometric measurement of the coexisting inclusions shows that they homogenize to the same temperature, indicating that the ore-forming fluid experienced boiling.

According to Bi [1], three types of fluid inclusions in quartz crystals from Qitianling A-type granite, namely, melt inclusions, fluid-melt inclusions and fluid inclusions were identified and hydrothermal fluid derived from the Qitianling granite during differentiation has the salinity of 32.98 ~ 52.04 wt%NaCl equiv and composition of CO_2- NaCl-KCl-$CaCl_2$-H_2O. Newly published He, Ar isotopic data show the ore-forming fluids have magmatic or mantle sources [2]. These evidences convincingly imply that ore-forming fluids were dominantly of magmatic origin sourced from the Qitianling granitic magma during magma differentiation. Fluid boiling induced by pressure reduction and mixing of high and low temperature fluids is the main mechanism of the tin precipitation of Furong tin polymetallic deposit.

[1] Bi *et al*. (2008) *Geol. J. of China Universities* **14**, 539–548. [2] Li *et al*. (2007) *Lithos* **97**, 161–173.