Discovery of metals-rich hydrothermal manganese deposits in the South-West Pacific

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Manganese oxides in the deep marine environment can be separated in three genetic groups: (i) hydrothermal, (ii) hydrogenetic, and (iii) diagenetic. The hydrothermal Mn deposits are characterized by low to very low contents of Cu, Ni, Co, Zn whereas the hydrogenetic Mn deposits can be enriched in a characteristic suite of trace elements (e.g. Co, Ni, Zn, REE, HFSE, Pt). As a consequence, only hydrogenetic manganese crusts and polymetallic nodules have been considered as a potential resource for some commercially important metals. Here we report on occurrence of metals-rich hydrothermal manganese deposits discovered in the south-west Pacific during a French cruise (fall 2010). These deposits occur at depth between 800m and 1800m and are controlled by volcanic structures. Volcanism is dominated by pyroclastic rocks (e.g. hyaloclastite, tuffite, pumice) at depth shallower than 1000 m and by pillow-lavas at greater depth. Mineralization occurs as crusts, meter-scale mounds and impregnations composed of well-crystallized birnessite and todorokite with variable amount of iron oxy-hydroxide and nontronite. The manganese oxides exhibit bluish-black to grey-black color with a submetallic luster typical of many hydrothermal Mn mineralizations [1]. Mn oxides are abnormally enriched in Ni (up to 4.6%), Co (up to 2.2%) and Cu (1.5%) but exhibit low REE and HFSE concentrations. Post-Archean Australian Shale-normalized REE patterns exhibit typical seawater signature with prominent negative Ce anomalies. Therefore, trace elements data point to a contribution of hydrothermal fluids for Ni, Co and Cu and a seawater contribution for REE and HFSE. Further, different genetic models to explain the mechanism for metal enrichment will be discussed.

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Organic geochemisty of the Late Paleozoic black mudstone in Hailaer basin, NE China: Implications for hydrocarbon-forming potential

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It is being dissussed hotly that whether the Late Paleozoic strata in NE China have hydrocarbon forming potential or not. However, organic geochemical data of the black mudstones from the Late Paleozoic in Hailaer basin provides insights for that. It has been known that the Mesozoic strata in Hailaer Basin NE China, was a famous hydrocarbon accumulation zone. In addition, the outcrop rocks of the Carboniferous and Permian around the basin was in the late stage of diagenetic and low-lever metamorphic belt [1].

Amount to 39 wells of Beier and Wuerxun depression from Hailaer basin were drilled into the Paleozoic black mudstone, and the thickness of the mudstone is about 393m. In this research, organic geochemical analysis has been taken on 40 black mudstone samples from 11 selected wells. It is indicated that the TOC values ranged between 0.09% and 4.407%, with the mean value of 0.73%, and 40% samples are over threshold of the organic matter abundance (0.5).

Organic geochemical analytical data for the Late Paleozoic black mudstones in the well of Wu 9 and Bei 2 of Hailaer basin was collected from Daqing oil field. TOC values from Wu 9 (7 samples) show a mean value of 0.9%, and the maximum value is 1.66%, thus about 43% samples are moderate source rocks. The potential of pyrolysis hydrocarbon generation values are 4.4mg/g ~ 0.01mg/g (average 1.5mg/g), suggesting that 33.3% samples can be regarded as moderate source rocks. For the black mudstones from Bei 2 (29 samples), the average values for TOC and S1+S2 are 0.733% and 0.35 mg/g. The average value for IH is 26mg/g (maximum 123mg/g), showing a typical kerogen type of III. The mean values for Tmax and Ro are 433°C and 0.81, respectivety, suggested that the source rock are high maturity. Combined with the Paleozoic strata in Hailaer Basin is well-protected, we consider that this strata could have a good hydrocarbon-forming potential, and the source rocks from the Late Palezoic strata in Hailaer basin could be an ideal target for a new round of hydrocarbon exploration in NE China.

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