The discovery of oil source rocks in Jurassic Qiakemake Formation in the western Kuqa depression of Tarim basin, China

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The Kela-2 gas field impelled the big gas region development in Kuqa depression of Tarim basin, China. It is always thought that Triassic-Jurassic coal measures are the main gas source rocks. Coal measure source rocks are characterized by high abundance of organic matter, much low hydrocarbon potential (S1+S2<0.5mg/g), high maturity and gas-prone. In this study, a set of oil source rocks are found in Jurassic Qiakemake Formation in the western Kuqa Depression of Tarim Basin, China. The lithology is the gray-black muddy micritic dolomite. The geochemical data shows that the hydrocarbon-generating potential is great.

The extracted hydrocarbon content of this rock is up to 0.399% in Qiakemake Formation. The content of saturated hydrocarbons in chloroform bitumen is as high as 91% while that of aromatics, non-hydrocarbon and asphalt are 5%, 3% and 1% respectively. The carbon isotope value of chloroform bitumen is much negative with a value of -32.2‰. The chloroform bitumen in Lacustrine mudstone hydrocarbon source rocks in Triassic Huangshanjie Formation only reached the lower limit value of that in source rocks, with low content of saturated hydrocarbons. So, it can be concluded that, the micrite dolomite in Qiakemake Formation is a set of good source rock.

The source rock maturity in Qiakemake Formation is relatively low with Ro value of 0.8% ~ 1.2% and the highest pyrolysis peak temperature Tmax of 450°C ~ 480°C. The organic matter type is good and dominated by type I ~ II. The kerogen carbon isotope is also relatively light, generally less than -25 ‰ with the lowest value of -31.2 ‰. The total organic carbon is 0.5% ~ 7.26% with the average of 1.8%, hydrocarbon generation potential is 2 mg/g ~ 6mg/g, and hydrogen index is 100 mg/gTOC ~ 628mg/gTOC with an average of 109 mg/gTOC. All of the values are relatively high and have reached the standard of good hydrocarbon source rocks. The source rocks in Qiakemake Formation distributes mainly in the Awate area of Wushi Sag in the western Kuqa Depression. It is about 7000km^2 with the thickness of more than 50m. This is of great significance to the appraisal to the large-scale oil potential in the western Kuqa Depression.

Incorporation of arsenate into gypsum: Relevant to hydrometallurgical Iron-Arsenic coprecipitation process

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Arsenic is commonly present in most base metal and precious metal ores and concentrates as co-occurring minerals in various forms and is released into mineral processing solutions and effluents during extraction of metals by oxidation and acid dissolution of the arsenic-containing minerals. It is removed and immobilized using a so-called coprecipitation process and disposed safely as a stable solid for the prevention of contamination to nearby surface and ground waters.

In previous studies, we found that arsenate is present in the coprecipitate as adsorbed arsenate on ferrihydrite, poorly crystalline ferric arsenate and calcium iron arsenate (yukonite). Arsenic may also be incorporated into gypsum lattice structure via isomorphic substitution for sulfate during the coprecipitation process. This is not surprising since incorporation of arsenate ions into jarosite structure and incorporation of sulfate ions into scorodite structure were already reported. This work investigated the incorporation of arsenate into gypsum during the crystallization process at various pH. XRD, FTIR and SEM were employed to characterize the coprecipitated solids. The results showed that arsenate was measurably removed from solution during gypsum crystallization and the removal increased with increasing pH. At pH 3-8 where the system was undersaturated with respect to calcium arsenate, arsenate ions were incorporated into gypsum structure, whereas at pH ≥ 9, calcium arsenate was formed and constituted the major arsenate bearing species in the precipitated solids. The morphology of the precipitated gypsum was also altered in the presence of arsenate. The results suggest that incorporation of arsenate into gypsum also plays a role in arsenic removal and immobilization in hydrometallurgical iron-arsenate coprecipitation process.

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