GEOLOGICAL TYPES OF OIL SHALE DEPOSITS IN CHINA

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ABSTRACT

Oil shale deposits are widespread and discovered in all provinces and autonomous regions throughout the whole country. They generally occur in the places where tectonic activities are weak. At present, only two deposits are mined as fuel and building materials.

The ages of oil shales are from early Silurian to Neogene, the most important is Eogene.

In this paper, thier genetic types will be discussed according to the geological characteristics.

In China, oil shale deposits are widespread and discovered in all provinces and autonomous regions. But so far,no more detailed geological survey has been carried out for them,only a few have been explored.

Oil shales in China generally occur in the places where tectonic activities are weak, such as the edges of platforms, the basins in platforms, the intermontane basins in geosynclines; and always deposit in reducing environment under calm and shallow water. As for the component, besides organic matters, it mainly consists of sandy-clayey materials, a little calcium and sometimes rare and rare-earth elements. They are in black or brown colour with thin-banded structure;the ash is generally in the range of 70--80%; the oil yield varies from 4% to 8%, rarely exceed 10%. The heating value ranges from 5400 J/g (1300 cal/g) to 6300 J/g (1500 cal/g), only a few up to 20000 J/g (5000 cal/g). At present, only two deposits are mined as fuel and building materials.

The ages of these oil shales are from early Silurian to Neogene,

the most important is Eogene. In Southeast China, stone coal is widespread. It is a kind of shales with higher organic materials and significant algal relics. Therefore, some geologists think of that they are the products of oil shales through slight metamorphisim. The age of its generation is from Sinian to Cambrian, and its heating value varies between 3350 J/g (800 cal/g) and 5000 J/g (1200 cal/g).

On the basis of geological characteristics, these oil shales may be classified into following types:

A. marine sedimentary

a. neritic: This type is characterized by large scale, a litlle change on facies, low oil yield and heating value. In Hanzhong county of Shaanxi province, the deposit occurs in the black-dark gray shales of lower Silurian system, and is enriched in fossils of graptolite. It is thin-banded structure, the single layer is about 1.5-15mm. The ore is gray and fragile with scattered pyrite. the total thickness is about 6.3--23.26 m. The oil yield at surface is less than 4%.

b. lagoonal: This type is characterized by large scale, great change on facies, thickness, oil yield and heating value, e.g. in Bogda mountain of Xinjiang autonomous region, the deposit occurs in lower Permian system, it has a length of 125 km, a width about 9--15 km and a thickness of 100m--400m. In the ore deposit, there are some layers of sandy shale, muddy shale and dolomitic limestone. The number and thickness vary in a great range. The oil yield of the poor ore is 2--4%; and the rich ore 6.5% in average, max.18%; ash content ranges from 67% to 86%; heating value is 6700J/g--9100J/g (1596--2175 cal/g).

B. continental sedimentary (lake deposit):

a. subsiding lake: The deposits of this type are characterized by large area, steady facies, thin thickness, high oil yield and high heating value. According to the associated ores, they may be further classified into three subtypes.

① associated with coal: These deposits occur between coal and coaly shale, sometimes contain coals or contact with coal by facies change. Oil shale beds are thin (about 1 m) and extensive. oil yield varies from 4% to 30%. Heating value is about 12500J/g--21000J/g (3000--5000

cal/g), such as the oil shales lie in the Puxian county of Shanxi Province and Yanzhou region of Shandong Province.

② associated with oil-bearing sandstone: The subtype is characterized by interbedded oil shale and oil-bearing sandstone, e.g. in Tongchuan county of Shaanxi Province, oil shale is located in Yanchang formation of Triassic system, the total thickness of oil shales varies between 4 and 24m, the single bed is generally 1--2m thick. The ore is fragile and light, and burns very easily with oil yield ranging from 6--9%, S 1.81% and ash 76.38%.

③ individual oil shale: deposit is often located between sandstones and shales, and spreads over considerable areas with oil yield about 5--6%. For example, in Nongan county of Jilin Province, the deposit occurs between sandstones and shales of Cretaceous system and contains numerous ore beds, its total thickness is about 50--70 m, the single bed is several meters thick and the oil yield is 5--6%.

b. sag pond: It is characteristic of smaller area, large thickness and great variety of oil yield. According to associated ores, these deposits may be classified into following subtypes:

① associated with coal: Oil shale generally deposits on coalbed, its scale is larger than coal, sometimes it contains thin coals. The oil shales being exploited at present in China all belong to this subtype, such as Maoming and Fushun deposits.

Maoming deposit is located in Maoming county of Guangdong Province. The age of oil shale is Eogene. Its reserves are about 5.4 bn.t. Its floor is oil-bearing shale and muddy lignite. The root is white bauxitic mudstone containing lignite. The ore composition is water 10--18%, ash 70%, S 0.56--1.14%, N_2 0.29--3.36; oil yield 6.5% in average (ranging from 4% to 12%); and the heating value is 3900--7100 J/g (935--1700 cal/g).

In Fushun county of Liaoning Province, the ore occurs within Eogene system and occupies an area of 10 km long and 2--3 km wide, the thickness of oil shale is about 150 m, below which is coalbed about 50 m thick and on which lies calcium-rich green shale. Its reserves are 3.5 bn.t. with oil yield 4--18%, water 3.04%, ash 70%,S 0.15, N_2 0.25%,

average heating value is about 5900 J/g (1400 cal/g).

In above two deposits, there are massive poor oreswith oil yield less than 4%, its reserves are not estimated.

② associated with trona: The deposit covers small area but contains numerous thin oil shale beds which are always located beneath the trona beds. For example, in Tongbai county of Henan Province. Ores occur within Eogene system, oil shale, trona and dolomite form sequentially more than ten sedimentary cycles. The oil shale beds are about 1--3 m thick with oil yield more than 6%, and heating value varies between 11800--17400 J/g.

③ individual oil shale deposits are usually with sandstone roof and shale floor, large variation of thickness and oil yield, as well as numerous thiner ore beds. For example, in Huadian county of Jilin Province, the age of deposit is also Eogene. It contains more than tweenty oil shale beds, among which 5--13 beds are exploitable. Single bed is about 1--2 m thick with oil yield 6--12%, max 26%; the ash content is 60--74%, and heating value is 6280 J/g in average.