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MESOZOIC COMBUSTIBLE MINERAL RESOURCE BASINS IN MONGOLIA

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ABSTRACT

In Mongolia these are the combustible mineral resources in Upper Paleozoic and Mezozoic sediments. Most large basins with coal and all basins with oil bearing shales and petroleum are connected with Mezozoic continental formation. Usually, the biggest basins of combustible mineral resources concentrate in central, south and eastern intermountain troughs of Mongolia in Upper Mezozoic continental deposits. On Mongolian territory there are classified 17 ranks of combustible resources (petroleum, natural gas, oil shale and coal) by geological structure. From these basins in central, south and eastern parts of Mongolia the biggest basins are Mezozoic age. Every type of Mozozoic combustible mineral resources of Mongolia show individual nature of distribution. Mezozoic coal basins are distributed in different aged geological formations. Jurassic coal basins can be found usually in central and north, parth in west and south parts of the country. Little numbers of the deposits are in the eastern parts. In the Jurassic period coal accumulations happened in west and south parts of the territory. In the Cretaceous time coal accumulations was in the central, south and eartern parts. Oil shales in Lower Cretaceous are like coal basins distributed in central, eastern and south parts of the territory. Petroleum basins of Mongolia found in intermountain troughs in single geological formations, with associated coal and oil shales. These petroleum basins found in the Mezozoic intermountaine troughs are elongated from the

eastern of Mongolia (Tamsag) into south-west (Baruun Khuurai) and north-west (Uvs nuur) parts. The Mezozoic sediments contain combustible mineral resources accumulated in large basins of continental lacustrine enviroment was three stages of non-continious paleotectonic and paleogeographic development. In the first stage of formation produced continental depressions which accumulated prolivium and lacustrine sediments. These lacustrine sediments were rich in organic matter and were able to generate thick oil shales. Intermountain lake basins filled with terrigeneous materials, and lakes became marshy. At this time in central, eastern and southern parts of Mongolia thick accumulations of organic material was laid down, to produce coal. At the final stage generated marsh lakes in intermountain trouhgs according to paleotectonism and climate. Poor organic matter filled with coarse terrigeneous materials , to be in contact with Lower and Upper Cretaceous.

INTRODUCTION

In the territory of Mongolia basins of combustible mineral resources are located and filled with Mezozoic continental deposits in wide troughs. These troughs lie in the central, eastern and soutern areas of the country. Total square dimensions of the trouhgs reach 450 thousand sq. km-s. Oil, oil shale, natural gas, bitumen and coal beddings are revealed in the Jurassic, Cretaceous sedimentary deposits of the troughs and are named as Mezozoic `rifting` troughs. As to the regards of geographic expansion, oil shale 8 which is considered an origin of oil, is found to the east of the 98th Lantitude. Here on this huge area, there are 13 exceptional basins. Althouhg the basins are not relatively the same size in general, it may be said that their geological structure and features of combustible mineral resource expansion is identical.

Stratigraphy and lithology of the Mezozoic sedimentary deposits

Lake valleys Gobi-Altai and Ongiin gol basins constitute the western part of the Mezozoic combustible mineral resource basin. Jurassic, Cretaceous sedmentary deposits of these basins refer to bakhar (Lower-Middle Jurassic), nuraach (Middle Jurassic), toromkhon (Lower Jurassic), underukhaa (Lower Jurassic-Lower Ctetaceous), andkhudag (Lower Cretaceous), khulsingol (Lower Cretaceous) suites (Sckuvalov, 1975) in the central, southern and eastern areas the deposits refey to Tsagaantsav suite, Dzunbayan series (Bat-Erdene, 1992).

Bakhar suite. The thickness is uo to 2500m. This suite contains deposits which consist of sedmentary and volcanogenic rocks.

Throughout this section of the given suite, there are conglomerate, gravelstone, sandstone, aleurolite, argillite, coal, volcanogenic rocks of various composition and acidic tuff. At the bottom of the section there mainly consists of coarsegrained deposits, near the surface there are coal and comparatively close-grained rocks.

Nuraach suite. Thickness is up to 1400m. Nuraach suite deposits mostly contains volcanogenic and tuffaceuos rocks. Volcanogenic rocks of intermediate, acidic and basic composition were also there; tuff, tuff-conglomerate, tuff-brecia, tuff-sandstone were revealed here.

Toromkhon suite. This suite mainly consists of the red deposits. Its thickness is up 1200m. Near the surface of the section there are conglomerate-brecia, conglomerate, sandstone, sandy clay basal volcanogebic rocks.

Undurukhaa suite. The thickness of this suite is up to 1000m. It contains volcanogenic and sedimentary rocks of grey color. Throughout this section of the suite there were found conglomerate gravelstone, sandstone, layevs of argillaceous and calcareous rocks, basalt.

Andkhudag suite. Its thickness is up to 700m. This suite is peculiar of its sandy-clay-schistose deposit. Fossile bedding of bituminuos clay paper shale, dark grey clay, aleurolite, argillite constitute the major part of the section. Sandstone, limestone, marl and coal beds are found rarely.

Khulsin gol suite. The thickness is up to 650m. The base of the given suite mainly contais sandstone, slates; and the part consists of sandstone, gravelstone, conglomerate and in some places there is a bed of basal volcanogenic rock. Total thickness of the above mentioned deposits of Jurassic and Cretaceous age is mote than 7000m.

Sections of the combustible mineral resources-bearing deposit, which is in the central, southern and eastern part of the Mezozoic troughs, begins lower Cretaceous Tsagaantsav suite.

Tsagaantsav suite. In eastern Mongolia this suite forms sections of 2 types. In the Choir, Nyalga, Choibalsan troughs of Mezozoic age, Tsagaantsav suite mostly consists of various composition volcanogenic rocks, in the other wide troughs, like East Gobi, Tamsag, Middle Gobi, its mainly composed of sedimentary rocks as gravelstone, sandstone, aleurolite, argillite and sometimes thin beds of oil shale. The horizon of zeolites was revealed here, too. Thickness of the suite reaches 1000m.

Dzunbayan series. Sections of the Dzunbayan series are divided on the following 3 formnations: shale-bearing, coal-bearing and sandstone-conglomerate-bearing formations.

Shail-bearing formation. In the central part og the troughs at the bottom of shale-bearing formations, there is a bundle of conglomerate

and sandstone with a thickness up to 100m. Above here, there are sandy limestone, siderite, dolomite, clay mare, thin beds of sandstone, aleurolite containing bitumen-bearing oil shale horizon and heavy rock mass like argillite. In someplaces sandstone and thin beds of carbonate are rich in natural bitumen. In the marginal part of the troughs throughout the shale-bearing formations section there are variegated coarse rocks-conglomerate, gravelstone, thin beds of clay like argillite, sandstone containing thin beds of aleurolite. Coal horizons with high ash content and low thickness are found insome places.

Coal-bearing formation. Coal- bearing formation is composed of conglomerate, gravelstone, sandstone, clay like argillite and heavy hofizons of coal. The base of the section contains coarse clastic rocks that nearer the surfase pass to close clastic rocks. Thickness of the given formation reaches 730-770m.

Sandstone-conglomerate-bearing formation. This formation is bedded on the surface of the coal-bearing formations wisout and is composed of conglomerate, sandstone rocks mass containing thin beds of gravelstone. There are bundles of tuffaecous rocks here with a thickness up to 200m. Bodies in the form of 200m thick hoizons of basic and intermediate effusive rocks are to be observed in the upper part of the Nyalga and Choibalsan troughs section. Tuffasandstone, tuffa-aleurolite, tuffa, sometimes bundles of volcangenic rocks that consist of basic rocks cover are found here.

Deposits and basins off combustible mineral resources

On the territory of Mongolia there were revealed 13 basins within which there are about 50 oil shale fields, 90 coal deposits, 3 natural bitumen and 10 oil fields (Fig. . .).

Oilshale field. Oilshale fields have been studied within the last 50 years. In general this research was aumed at other minerals rather than at oilshale. But within the last 10 years special investigations were cavried out on some fields and basins. Significantly thick stratum of argillacrous shale rocks was revealed in the all Mesozoic trough in the shale-bearing formation of the Dzunbayan series and troughout the section of andkhudag suite. Stratum of the argillaceous-shale deposit that contains oil shale thick bedding is distributed in the extremely large area of central, southern and eastern Mongolia. Oilshale bedding has a considerably more complex stracture; in most cases 10-30 horizons are to be observed throughout one section. Thickness of some horizons are extremely high (128m), basically thickness of argillaceous shale rocks is 300m, sometimes its rather more than usual. According to the present results of the laboratory analysee content of organic matters doesn`t

exseed 20%, in general almost in the all regions, this content is bellow this level; outflow of tar in organic matters reaches 29.6%, but in most cases it does not exceed 5-10%. Now lets consider the indices of better studied deposits and basins. At the Nyalga basin deposit of oil shale, like Uvdug Khooloin Khushuu, Naringol, Bayan-Erkhet, Bayanzhargalan, Tugrug, Khumultei, deposits had been studied to some extent. Heavy bedding of oil shale is revealed in the last 4 deposits. According to the results of the laboratory analyses, content of organic matters is 15-23%, outflowof tar reaches 13.1-17.5%. At the Middle Gobi basin in the Shavart Ovoo, Eidemt, Khashaat, Khudag oil shale deposit outflow of tar is up to 10% which is comparatively higher than usual. In the Eidemt deposit, oil shale has tar of uniform-spread and higher content. At the Tamsag basin oil shale of the Suman Undur deposit has the highest in our country content of far which 20.6%. In the Khavkhastai oil shale occurrence of southern gobi outflow of tar reaches 12%. In the Khugshingol, Dzanbulag oil shale deposits of the Ugiinnuur basin outflow of tar doesn`t exceed 6%. Although V.Schuvalov (1975) gave the descriptions of many significantly thick oil shales sections at the Gobi Altai, Ongingol oil shale basin (andkhudag suite), indices of their quality have not been studied absolutely.

Coal deposits. Mesozoic coal has been studied and observed in Mongolia within the recent 70 years. A Lower Cretaceous coal deposit was revealed in the western part of the Mesozoic troughs at the lakes valley, Gogi Altai, Ongingol, South Gobi, Tugrug basins and other basins of Lower Middle Jurassic, Lower Cretaceous age. In the Jurassic deposits there are 15 coal horizons where thickness of the main horizon reaches 50m. The Degree of coal metamorphism conforms to the period of transition to hard coal. The Lower Cretaceous coal deposits contain up to 20 horizons and 5 of them are considered as the horizons with significantly heavy thickness. Thickness of some deposit horizons is more than 100m. Degree of coal metamorphism reaches the level of brown coal. Quality indices of Lower Cretaceous coal on the hude area of expansion are relatively constant ash content is 10-20%, outflow of volatively is 40-50%, sulphur content is comparatively high and reaches 2.5%. Material composition of Mesozoic coal has its own specific peculiarity. When in central Mongolia Jurassic coal is `Vitrinized`, mostly altraclarain and clarain, sometimes it is rich in leptinite (Alagtsakhir) and has a high fat content, Lower Cretaceous coal has a high content of inertinite (up to 40%, Shivee Ovoo).

The main oil deposits are the Dzunbayan, Tsagaahels deposits that are located in the East Gobi basin. The Dzunbayan deposits contains Tsagaantsav suite. At the bottom of this suites section with a thickness of 220-230m and section of the shale-bearing Dzunbavan

series has a thickness of the about 500m containing 3 bundles of oil. There are 39 oil horizons in the Tsagaantasav suite. The oil of the given suite has a high paraffin cintent which downwardly increases. Oils density is 0.917-0.855 (the depth tends to increase), paraffin content is 3.36-23.5%, mets down at 55^{0}C, solidifies at 23^{0}C. Besides the East Gobi basin, oil horizons were revealed at the Choibalsan, Tamsag, Nyalga, Ugiinnuur basins. At the present time above mentioned oil basins are considered the promising basins.

Depositing conditions of the sedimentary deposits, containing Mesozoic combustible mineral resources

During the Mesozoic are the whole territory of Mongolia was evolving under continental conditions. At Triassic time, tremendous uplift was formed here and a few small basins started to accumulate deposits. At the beginning of Jurassic, main basins of the continental deposits were concentrated in central Mongolia. Bakhar, nuraach, toromkhon, undurukhaa suites of a considerably heavy thickness, were deposited in the lakes basins and river valley. At Lower Cretaceous time basins of Jurassic sedimentation expanded a great degree and thick horizons of oil shale started to be deposited in the tremendously deep lakes. These lakes basins were vichin organics and had a farly stable regime of river that created favourable conditions for the depositing process of the oil shale which is an origin of oil. At the end of barremian, the lake basins had been lost and tectonic activization had increvsed that it created other conditions of thesedimentation, as aresult of which alluvial, fairly large basins of small residual lakes began to form here. This it was a paleo-geographical condition of the Cretacepus tremendous coal ooccurrenceaccumulation in eastern Mongolia. Although organic matter of the coal is autochtontus its interesting that first petrographers came to the conclusion that some thick horizons in eastern Mongolia a had been deposited under allochthonous conditions (For instance, Bulangin khooloi horizon). Horizons of the aduunchuluun, Ikh Uiaan fields might be deposited under allochonous conditions too. The period when tremendous coal deposits occurred was replaced by the tectonic activization and climate aridity and a new are of the Mesozoic troughs evolution was beginning corresponds to the time of Khulgingol sandstone-conglomerate-bearing suite. Relatively coarse-grained, in some places varigated deposits that were deposited during this time, passed over the Mesozoic troughs-rifting-the evolution stage. This now you see how significantly large basins containing combustible mineral resource bedding were formed in eartern Mongolia in Jurassic, Cretaceous times.

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