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NATURE OF DISTRIBUTION AND FORMATION OF COAL BASINS IN MONGOLIA

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ABSTRACT

This article adduces a new scheme of coal-bearing zonation and the results of complex research on the various age peat accumulations coal-bearing deposits. The analysis of the paleotectonic and paleogeographic conditions of peat accumulation allowed to expose the general evolution of development in accordance with which there distinquished 3 stages of coal-bearing structures development: pimary or preparatory stage, when the full compensation of the depresions by the sedimentation goes on; -middle stage-stage of mass peat accumulation process's stopping.

These srages are the typical features of the coal-bearing structures development on the territory of Mongolia.

INTRODUCTION

Field edstribution of various age coal basins on the territory of Mongolia has the following features.

Carboniferous coals are concentrated in the boundaries of the West Mongolian coal-bearing provice, where it's stood out Mongol-Altai and Kharkhiran coal basins, Trans-Altai and Bayan-Ulgii coal fields. Fields with the oldest coal formation cover the extreme south part of the province, in the boundary of the hercynian structures. To the

north of them Mongol-Altai basin is located in the boundaries of late caledonian folded constructions, where the middle part of middle-upper carbonaferous section is coal-bearing.

Kharkhiran basin with coal seam in the upper-carbonaferous section covers the extreme north part of the province at the junction of late and early caledonian and baikalian folded structures.

The permian coal basins as South Khangai and South Gobi basins are located to the east of the area of carbonaferous coal formation. The South Khangai basin which has tenor of coal in the upper permian section, covers the region of coupling north mongolian baikalids and mongol-transbaikalian hercynids structures. The South Gobi basin, where the upper part of section has tenor of coal, is located on the zone of coupling south-mongolian hercynids and south-gobi caledonids. In other respects of the territory was distributed small little thickness coal seams of permian age.

Mezozoic tenor of coal has the largest field of the distribution. Lower-middle jurassic coal deposits are spread on the west, south-west and south of the country, in the boundaries of the West-mongolian coal-bearing province, Ikh bogd, Ongiin gol and East-gobi coal basins. Coal deposits of middle-jurassic age are expanded on Orkhon-Selenge coal-bearinf fields, in the east part having peat accumulation on even in section late jurassic and early cretaceous as on the bordering territory of Russia.

The cretaceous peat accumulation occupied the east half part of Mongolian territory, to the east of zone of coupling Mongolian and Go bi Altai structures. Here, where stood out the East Mongolian coal-bearing province with 6 basins; Choir-Nyalga, Choibalsan, Sukhbator, Tamsag, Middle-and East Gobi.

To the west of there, in the Ongiin gol and Ikh bogd coal basins the lower part of lower cretaceous section has tenor of coal limited hauteravian and barremian times.

I. Stratigraphy of coal-bearing formation

The deposits of the above mentioned ages are presented by continental, cyclic nature, volcanogenic-sedimentary series [1, 2, 3].

The middle-upper carbonaferous age coal deposits of the West Mongolian province are segregated out to Altai sery with 3 suites; lower, middle and upper. The upper permian deposits of South Gobi basin-Tavantolgoi sery with 2 suites; variageted and coal-bearing, and lower cretaceous deposits of the East Mongolian province-Dzunbayan sery with 3 suites-shale-bearing, coal-bearing and sandy-conglomerate.

The coal deposits of upper paleozoic age with erosion and unconformity are bedded on the lower lied folded formations, separated from the recovering deposits by the regional erosion interruption and angular inconformity. Lateral alterations kind of depositions are very esential. All the coal deposits over space change into the non-coal deposits only in direction of the most consolidated, not mobile structures. On the contrary, the section becomes essentially volcanogenic in direction of younger amd mobile area. It's possible to observe in the West Mongolian province, and South Gobi basin. The coal-bearing deposits of upper paleozoic have a thickness up to 2700m. On the bottom they're composed of coatse-grained sediments, which above change to fine grained deposits with coal seams. The tops of the section are characterized by sharps reduced coal accumulation and changed to full disappearance with the syncronous coarsening of the sediments. Usually upper mezozoic depressions of the coal-bearing deposits have more complex composition.

Inside of the some inherited depressions deposits have gradual transition from lower-lied formations. Only in the marginal parts most depressions of East Mongolian province, Orkhin-Selenge field, Ikh bogd and Ongiin gol basins, where sedimentational basins occupied big areas, the coal-bearing deposits are bedded with the regional erosion and angular uncomformity on the folded fundaments. The recovering deposits on the coal-bearing sediments bedded with regional and angular unconformity.

Over lateral the mezozoic coal-bearing deposits are changed into the non-coal deposits that are often, party coloured coarse-grained sediments without volcanogenic rocks (in direction of the West Mongolian province). Coal-bearing deposits have a thickness up to 2000m in the inner parts of the huge depressions on the bottom of section bu fowerfull argillaceous-shale series that trans for to coarse grained deposits on the marginal zone of the structures. Coal-bearing part of the section with a thickness 300m, that changed fowerfull non-coal coarse grained sediments with remains polycoloured. Besides of coals the deposits contain vein of oil, shale, zeolit and natural bitumens various appoint sands and clays. All coal-bearing deposits contain volkanite. On the bottom of the section predominated acid and subalkalic volkanite to the above section transiented to basic and medium content of volcanite.

II. Facial composition of coal-bearing formation

Such nature alteration of the section is used for elaboration of the stratigraphy of caol-bearing deposits [1].

On the content of the coal-bearing deposits of the investigated province share out following bigs facial groups; proluvial , alluvial, lacustrine, lacustrine-marsh, peat-marsh. The most common deposits are the alluvial deposits. They are made up to the lower basal and the very upper horizons of the coal-bearing series independently of their ages.

Besides small thickness seams of the alluvial deposits take part in the composition of the sections coal-bearing part (west side of South gobi coal-bearing basin).

Lacustrine deposits are wide spread. They are mostly councided to the lower parts pf the coal-bearing series and only in single event are spread in the upper horizons (Kharkhiran, Choir-Nyalga and other basins).

The proluvial deposits are in the third place by a prevalence throughout the sections of the coal-bearing deposits mainly having made up to their basal horizons, at last, the lacustrine-marsh, peat-marsh coal deposits, that are connected between themselves both throughout the section and in the square, constitute the approximately equal parts. Principally, they are developed in the parts of the depressions which are most moved of from areas of an ablation.

III. Sedimentation cycles

The coal-bearing deposits have a well-expressed cyclic composition. The sedimentational cycles of various degree, are structured for midland intermontane trouhgs. The complex if indications-morphology, granulometric composition, structure, facial composition, tenor of coal and thickness-gives opportunity to pick out full, sedimentational cycles between erosional, wash-pits in the base og the most coarse-grained rocks of proluvial and alluvial facies. Various combinations of full sedimentational cycles are notable throughout the summary sections of the coal-bearing deposits.

Various combinations of full sedimentational cycles constitute mezo-, macro- and megacycles. 14-16 gull sedimentational cycles are notable throughout the summary sections of the coal-bearing deposits.

The full sedimentational cycles in the base are often made up of the comparatively coarse-grained rocks, that above gradually pass to more close petroclastic rocks. The upper part of the cycles consists of aleurolites, argillites and coals. The section of most cycles ends by coal and some cases-by argillites. If the alluvial deposits are bedded in the base of the cycle than the prevous cycle, as a rule is washed out to various depth.

More or less large independent stages of coal formation in coal-containing structures are mezocycles. Their formation is conditioned by

facial-geotectonical factors. But it's not possible to except here landscape-climatic factors complicating the content and composition of these cycles. The landscape-climatic factors are important in the formation of lower degree cycles too, which is shown from composition's strong spatial variation, content and thickness of cycles and especially elementary cycles.

IY. Coal seams

Upper paleozoic and mezozoic coal-bearing deposits contain supervigorous coal layers of complex composition. For upper paleozoic and mezozoic there are appropriate, definitely expressed changes of both quantitative and qualitative characters of tenor of coal.

The most thickness coal seams are contained in the middle-upper carboniferous, upper permian and lower cretaceous deposits 15-25 coal seams are revealed throughout the summary sections. Each basin of them has 5-6 super-vigorous coal layers. As a whole it is known approximately 100 super-vigorous layers in the country. In the West Mongolian coal-bearing province the maximal thickness of the coal layers reaches 85m, in the South gobi basin-100m, in the East Mongolian coal-shale-bearing province-more than 100m. The super-vigorous layers in the upper paleozoic basins have comparatively bigger squares than in the mezozoic basins. Thay all are presented by unmatured, fissionable (splitting) and pinching bodies. The super-vigorous coal layers present the unique geological phenomenon and have an exceptional practical value.

A degree of coalification is received to the definite change over coal basins. Within the boundaries of the West Mongolian coal-bearing province the carboniferous coals are most strongly alterated (probably, till antracites) in the Mongol Altai basin, Trans Altai and Bayan Ulgii coal-bearing fields and coals of Kharkhiran South Khangai, South Gobi basins are bitumeneous, cretaceous coals correspond to brown coals and are most strongly alterated in the west side of their development's square.

Y. Petrographic composition of coal

All coals correspond to the humic coals and their petrographic composition slightly varies over basins and provinces. Features of the West Mongolian coal-bearing province ate the primary heliumized composition and full absence of lipoid components in coals of Mongol Altai basin because of a coalification's high degree.

Coals of the South Gobi basin are notable for a higher content of inertinites and involved with it mineral admixtures in comparisen with the West Mongolian carboniferous coals. Intertinites are more important in the cretaceous coals of the East Mongolian province (up to 30%) in which, besides it, the structural vitrinite and pitch bodies are widely developed (1;6).

An increase of the content of inertinites in coal seams with the age rejuvenation reflects the evolution of paleogeographical and paleotectonical conditions of peat accumulation for a period of the upper paleozoic-upper mezlzoic. These conditions were more and more provoking the complication of coal seams and decrease of intermontane trough's squares in due course.

In one's turn, it stipulates a change of the coals qualities basic indices, initially, a change of ash content. Ash content is in direct subject to changeableness of the coal seams composition and thickness, to character of their splitting and pinching out. Hence, the largest ash content of coal is typical for the marginal parts of coal deams, on the contrary, it considerably decreases in the central parts. Besides, since the squares of scarcely-ashful coals spread from the lower horizons to the upper ones are steadily decreasing and the squares of highly-ashful coals' square. Is considerably increasing, it's clearly revealed increase of degree of coals obstructioning by mineral admixture throughout the stratigraphic section. Exposed nature of distribution of ash content and other indices of coals quality in total with the datas about thickness and composition of coal seams and their changebleness on the square may become a safe basis for the reconstruction of the boundaries of paleo-peat bodies of the depressions' width and e. t. c.

YI. Conditions of peat accumulation

Features of the process of various age peat accumulation began on the territory of Mongolia, sea conditions of the sedimentation existed only in Mongolo-transbaikalian and Inner-mongolian systems, and the continental situations prevailed on the rest territory.

Carboniferous peat accumulation was going on only in the boundaries of the medern West Mongolian province. Inheritted from the previous stage of development, sedimentary basin existed on the south of the province, in the boundaries of hercynian folded area. In due course area of the sedimentation and peat accumulation in the northern direction was gradually expanding with synchronous decrease of it on the south of the province. Spatial-temporary migration of peat accumulation process to the north is clearly revealed in the boundaries

of altai sery's 3 suites. It's available to watch such tendency inside of the separate stades of peat accumulation and especially inside of the middle and upper suites. Sinchronously, scale of peat accumulation eas steadily increasing and by the and of carboniferous period on the marginal north of the province an accumulation of the most vigorous peat msaaes came over.

Reason of such spatial-temporary evolution of the West Mongolian province sedimentation's basin, in all probability, is consealed in general mobility and gradual activization of geotectonical regime in the hercynian folded systems of Southern Mongolia in comparison with north, the most stabilized areas of baikalian and caledonian foldings. In due course tectonic activity was covering larger and larger square in the direction from the south to the north that at last it stipulated a complete stopping of a peat accumulation at the end of carboniferous period.

Peat accumulation of permian period is notable for considerably larger square development and stronger intensity. Basins of the permian peat accumulation, which are basins of general latitudinal strike, are divided between themselves by South Mongolian hercynian folded system.

In the boundaries of Ozernaya zone and Central Mongolian folded system the most vigorous and persistent peat swamps existed in the south frame of Khangai sinclinorium. To the south of here, in the zone of South Gobi and South Mongolian folded systems articulation vigorous peat swamps developed on the square on the modern South Gobi coal-bearing basin. On the first phases of peat swamps' (bottoms of tavantolgoi sery's coal-bearing suite) development, apparently, the north-east part of South Gobi paleodepression experienced the arrangements under the influence of still active South Mongolian hercynid and was filled up by coarse-petroclastic sediments. In due course the larger and larger area received an activization and in essense at the end of late permian, the whole basin was found it self in the zone of more and more gained strength movements, that had been the basic factors of peat accumulation process's stopping. To all appearances, activization of geotectonical regime was typical for the central and eastern parts of Mongolia for tops of permian, that stipulated an establishment of the unfavourable conditions for peat accumulation in triassic period.

Feature of peat accumulation within jurassic epoch is in that it went on after a long period of peat accumulation process's absence. In Mongolia coal seams of this age are most widespread, but the general scale of coal formation yields to other epochs. The most vigorous seam

scale of jurassic epoch reach 60m, but the quantity of them throughout one section reaches 50m.

The last stage of the vigorous peat accumulation came in lower cretaceous, on the great territory of central and eastern Mongolia. Here this time a vast het of paleodepressions developed. As a rule, central parts of comparatively large depressions were full of the lacustrine basins and marginal zones and linked the depressions between themselves harrow extensive straits represented the areas of an accumulation of the proluvial coarse-petroclastic deposits. Argillaceous deposits with the vigorous horizons of oil shales were accumulated in the lacustrine basins.

Due to steadily existed lacustrine basins in some large depressions favourable conditions for peat accumulation come in unsinchronously. Maximal quantity and the greatest thickness of coal seams are typical for the north-eastern depressions, in which, in essence, peat accumulation went on within the whole period of an accumulation of dzunbayan serry's coal-bearing suite 5 vigorous and super-vigorous coal seams formed in the majority of these depressions.

At the end of dzunbayan time an activity of the tectonic movements gained strength appreciable, in consequence of what the upper part of the coal-bearing suite's section was washed out. It marked the beginning of early cretaceous sedimentation areas structural plans reconstruction and approach of the new stage of the sedimentation (sandyconglomerate suite). Whole area received general uplift and considerable decrease of the sedimentation's squares. Peat accumulation stopped completely.

Confrontation of the coal deposits accumulation's condotions in the various age structures allows to expose are general trait; the same evolution of the facial-landscape situations within a time. In accordance with it we distinquish 3 stages of the coal-bearing structures' development; primary stage-or preparatory stage, when the full compensation of depressions by the sedimentation goes on, that it provide the possibility of coal accumulation; middle satge-stage of mass peat accumulation and final stage-stage of peat accumulation process's stopping. Each of these steges is charachterized by its geotectonic regime in all studied coal-bearing structures of Mongolia and implemented by the continental coal-bearing deposits. Hence, it's apparently available to say that this evolution is one of the typical features of coal-bearing structures development.

SUMMARY

Having finished description of the coal-bearing deposits accumulation's conditions, we should stress that the age migration of coal formation on the territory of Mongolia is subordinated to the features of various age folded systems development and consolidation.

The subordination of coal formation to the features of various age fold systems' development in paleozoic and mesozoic becomes apparent in different ways. An observation of temporary and spatial distribution of upper paleozoic peat accumulation exposes its clearly expressed migration from the areas of the youngest folding to the oldest ons; in the West Mongolian coal-bearing province-from South Mongolian hercynids in the direction of North Mongolian caledonids and baikalids during carboniferous time, in central and southern Mongolia-from Mongolo-transbaikalian folded system to South Gobi during permian time; in mezozoic the age migration of coal accumulation went on from the oldest stabilized folded constructions to the youndest ones, i.e. in the general latitudinal direction-from the west to the east.

The spatial timing of coal basins to the large folded constructions is different, too. If coal basins of late paleozoic age, as a rule, are timed to the joints of various age folded systems, then upper mezozoic coal-and coal-shale-bearing basins are located in the boundaries of the inner depressions.

Comparative analysis shows that, having started from middle carboniferous epoch till early cretaceous epoch inclusive, both a thickness of the separate coal seams and in total basic stratigraphic levels summary resources of coal formation was gradually increasing.

REFERENCES

1. Bat-Erdene D. Lower cretaceous coal-bearing deposits of Choir trough, Eastern Mongolia. -Doctorate thesis, Irkutsk, 1976
2. Bat-Erdene D. New data about the coal-bearing deposits of carboniferous period of Kharkhiran area, Western Mongolia. -Bull. of IGE, vol.1, Moscow, 1980.
3. Bat-Erdene D. Recurrence of lower cretaceous age coal-bearing deposits` composition in Eastern Mongolia.-Geological problems of Eastern Mongolia and contiguous territories, Irkutsk, 1984.

4. Bat-Erdene D.Nature of distribution and formational condition of coal-bearing basins of Mongolian orogenic belt.-Doctorate thesis, Moscow, 1992.
5. Bat-Erdene D., Shakov R.A., Chimeddorj A. State and perspectives of raw materials source`s development in full-energentic industry of Mongolia.-In book: Soviet-Mongolian collaboration in geology`s area: results and perspectives. Moscow, 1986.
6. Jargal L., Bat-Erdene D., Shorin V.P. Petrographical composition of coal in the West Mongolian province.-Geology and exploration of interior of the earth in Mongolia, Ulaanbaatar, 1989.