

SUMMARY

of dissertation for academic degree of Doctor of Philosophy (PhD)
in educational program 8D07201 – Geology and Exploration of Mineral Deposits

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STUDYING THE STRUCTURAL-TECTONIC POSITION AND MINERAGENY OF THE ZHAILMA GRABEN SYNCLINE

Kazakhstan that occupies the area of almost 2700 million km², has large reserves of various mineral and raw materials. They together form not only the basis of the economy of the Republic but are also of great interest to almost the entire world community.

One of the most geologically interesting territories of Kazakhstan is its central part. The industrial value of Central Kazakhstan is associated with the Atasu ore region, the main and ore-controlling structure of which is the Zhailma graben-syncline. Industrial deposits of rich and easily enriched iron-manganese ores, lead-zinc and barite-polymetallic ores are concentrated here.

The exploration model of the Zhailma trough, a unique structure in terms of ore saturation, was developed in the fifties and eighties of the last century (30-70 years ago). The model in particular assumes the independent development of the structure as a rift, riftogenic one, and the genesis of mineralization due to the presence of volcanogenic formations in the ore field, as volcanogenic-sedimentary. This model that is based on the postulates of the geosynclinal theory, seems to be overly complicated and is not very suitable for predictive metallogenic purposes. In connection with the development of a new paradigm, plate tectonics, there occurred an urgent need to revise the problems of regional metallogenic constructions, the patterns of formation and localization of "Atasu type" mineralization.

Volcanism is one of the most important characteristics of the tectonic mode; therefore, the interest in the relationship between volcanism and tectonics is currently growing. This is largely explained by the fact that both processes reflect the life of the upper mantle and thus provide the key to solving one of the main problems of today's geology: awareness of the subcrustal depths of the Earth and establishing the laws of their development.

Topicality of the dissertation work. At present, in Central Kazakhstan, the reserves of previously explored deposits are being redeemed, there are no new large discoveries, and exploration work is mainly carried out at objects that are small in terms of reserves "rejected" earlier at the exploration stage.

Perhaps this situation was a consequence of the fact that the existing ideas of the geodynamic development of metallogenic zones, ore fields and the genesis of ore objects were largely outdated and required critical analysis and rethinking.

Given the absence of new geological and metallogenic material, the previously existing ideas of the geological and structural position and geodynamics and magmatism of the Zhailma trough require careful analysis and revision in order to develop its dynamic model as a predictive metallogenic basis for assessing the prospects of the adjacent sedimentary Famennian-Carboniferous basins.

Within the framework of the concepts of the State program of geological exploration for 2021-2025, the purpose of which is to form conditions for sustainable replenishment, development and support of the mineral resource base the competitiveness, the scientific world faces the following tasks:

- ensuring the geological knowledge of the territory of Kazakhstan;
- replenishing the mineral resource base (increase in mineral reserves);
- scientific and research support for the geological studying the subsoil.

At present, as before, Kazakhstan is assigned a significant role in the world economy for the production of non-ferrous, ferrous, precious and other types of minerals. Therefore, the search for

industrial accumulations of ores that meet present day market requirements in terms of quality and scale, and as a result the economic stabilization of the mineral resource base determine the applied value of the author's dissertation work.

The purpose of the work is studying the structural-tectonic position and minerageny of typical deposits of the Zhailma structure (Zhairem, Karazhal, Ushkatyn).

The tasks of the study are as follows:

1. To carry out a critical analysis and revision of pre-existing ideas of the position of the Zhailma trough in the tectonic structures of Central Kazakhstan and its genesis;
2. To determine the degree of possible impact of volcanism and magmatism on the formation of ores of the deposits located within Zhailma;
3. To develop new predictive metallogenic criteria as a basis for assessing the Famennian-Carboniferous structures of the Devonian volcanic belt to identify stratiform deposits of the Atasu type;
4. To interpret the results of isotopic and atomic emission analysis of the core of the Ushkatyn, Karazhal, Zhairem fields;
5. To assess the prospects of the deposits of the Zhailma structure for the presence of Au and Ag.

Scientific novelty. As a result of a critical analysis of the available factual material scattered in numerous publications, it has been concluded that this structure is an integral part of the marginal Devonian volcano-plutonic belt (DVPB).

The development of the Zhailma trough is genetically related to intense volcanic activity in the period from the early, middle and late Devonian, as a result of which, due to the emptying of the magma chambers of nearby stratovolcanoes, the surface subsidence occurred with the formation of a large volcanic depression. Intense volcanic activity ended probably in the middle of the Frasnian stage of the Upper Devonian. Thin red-colored siltstones, sandstones, and conglomerates of the Daira Formation, the bases of the Famennian-Carboniferous "ore-bearing" formation, overlie the dissected volcanogenic relief with a sharp angular unconformity.

Stratified volcanogenic formations (tuffs, tuffites, basalts) represent a facies of long-range transport. The rocks of the subvolcanic facies lying in the form of ridges at the base of the Famennian limestones are outcroppings of the Devonian paleovolcanoes remains. The established features make it possible to include in the category of prospective deposits of the Atasu type the Famennian-Carboniferous graben-synclines that are widely developed in the Sarysu-Teniz segment of the DVPB.

Practical significance. The prospecting model, genesis, specificity of the Zhailma trough mineralization are revised taking into account the volcano-tectonic origin of the structure. Qualitative recommendations have been developed for the graben-syncline searching throughout the entire area of the Sarysu-Teniz segment of the Devonian volcano-plutonic belt in order to identify deposits of the Atasu type. For the first time there has been substantiated in the laboratory and calculated the predictive quantitative potential of the Zhailma trough deposits for gold and silver content.

The author's personal contribution consists in participating in collecting surface samples as well as core material from the Zhairem, Ushkatyn and Karazhal deposits; in processing, systematizing, generalizing and interpreting the factual material; interpreting the results of isotope dating of rocks; reprocessing results of the Atomic Emission Spectrum Analysis (AES); calculating correlation coefficients; constructing patterns of interrelation of ore components; as well as in substantiating the relevance of the research work.

Scientific provisions to be defended

1. The Zhailma graben-syncline is an integral part of the Sarysu-Teniz segment of the DVPB, with which it is related both spatially and genetically. Its formation and graben-synclines formation actually marks the final stage of the tectonic development of the volcanic belt.

2. The formation of the Zhailma (ore-bearing) structure is closely related to the processes of active Devonian volcanic activity, which caused the formation of a large volcanic depression.

3. Participation of volcanism (magmatism) processes in the formation of deposits of the Atasu type was minimal and was expressed only in the development of a dissected pre-Famennian paleorelief, and the igneous formations themselves are protrusions of older pre-Famennian Givetian-Franian subvolcanic formations.

Publications and approbation. Based on the results of the research work, 10 scientific articles have been prepared and published including 2 articles in the journals included in the Scopus database and having a non-zero impact factor and 3 articles in the scientific journals recommended by the Committee for Quality Assurance in Education and Science of the RK MES. Many aspects of the work have been reported and discussed in the form of oral presentations at international, republican and university scientific conferences: in Russia the XXIV International Scientific Symposium of Students and Young Scientists named after Academician M.A. Ussov "Problems of Geology and Subsoil Development", Tomsk, 2020; the International forum-competition of students and young scientists "Actual problems of subsoil use 2020", St. Petersburg, 2020; in Belarus the III International Scientific Conference "Problems of Regional Geology of the west of the East European Platform and Adjacent Territories", Minsk, 2022, in Uzbekistan the International Conference "Information Technology and Engineering Geometry", Tashkent, 2022; in Kazakhstan the international conferences "Saginov's Readings No. 12", 2021.

The dissertation structure and volume. The dissertation is presented on 155 pages of a computer text and consists of an introduction, four chapters, a conclusion and a list of references including 86 titles. The dissertation is illustrated with 51 figures, 7 tables and 11 appendices.

Acknowledgments. The author expresses deep gratitude to the national scientific consultant, Doctor of Engineering, Professor of the G&EMD Department V.S. Portnov and foreign scientific consultant, Doctor of Geological and Mineralogical Sciences, Professor of the Institute of Geology of T. Shevchenko Kiev National University V.N. Zagnitko for assistance in selecting the scientific area, valuable recommendations, assistance in mastering calculation methods, as well as invaluable support throughout the entire period of doctoral studies.

The author expresses special deep gratitude to the outstanding geologist, Candidate of Technical Sciences Ye.G. Malchenko for mentoring, scientific support, valuable advice and comments in the process of preparing the dissertation work.

The author is especially grateful to the beloved friends, associates, young geologists O.A. Muratov and A.R. Nurshina for assistance in field work, collecting and processing the factual material, assistance in sample preparing and laboratory analysis, preparing graphic materials presented in the dissertation.