Q. Huang[1], Y. Zhu[2]
[1] CODES, School of Earth Science, University of Tasmania, Hobart, Australia, Qiuyue.huang@utas.edu.au
[2] Peking University, Pekin, China, yfzhu@pku.edu.cn

PETROLOGY AND GEOCHEMISTRY OF THE HALADALA PLUTON AND ASSOCIATED Au-BEARING HYDROTHERMAL VEINS IN SOUTHWESTERN TIAN SHAN, CHINA

Плутон Халадала (Юго-Западный Тянь-Шань) состоит преимущественно из троктолитов, оливинового габбро и габбро. Поведение РЗЭ и малых элементов свидетельствует о фракционировании первичной магмы. Наиболее поздними являются жилы магнетит-клинопироксенового габбро. Золотоносные кальцит-магнетитовые жилы являются результатом постмагматического эпитермального процесса.

The Haladala basic-ultrabasic pluton in Southwestern Tian Shan Mountains mainly consists of troctolite, olivine gabbro and gabbro [Zhang et al., 2000; Xue and Zhu., 2009]. After the fractional crystallization of olivine and plagioclase from the Haladala primary magma, the rest of the magma intruded and formed gabbro. The clinopyxene (Cpx-I) of the gabbro has the lowest concentration of Rare Earth Elements (REEs), and doesn't show Eu negative anomaly. The concentration of other trace elements (Sc, Cr etc.) of Cpx-I varies largely with a wide range of the Mg# (80–95). The magnetite-clinopyroxene vein intruded into the gabbro, and the composition of the clinopyxene (Cpx-II) in the vein is relatively consistent. Compared to Cpx-I, Cpx-II has a higher concentration of REEs with distinct Eu negative anomaly. At least two stages of heterogeneous magmas contributed to the formation of the Haladala pluton. Distinct from the rapid intrusion of the later-stage Fe-riched basic magma which formed the magnetite- clinopyxene vein, the early-stage magma went through a long period of evolution before it finally cooled down and formed the gabbro. Besides, exsolution texture can be found in both Cpx-I and Cpx-II, which implies that the Haladala pluton experienced rapid uplift or rapid cooling after the intrusion of the magnetite-clinopyroxene vein. Another auriferous calcite- magnetite vein came into being during the epithermal process after the magma process ended. The later vein ranges from 1mm–10cm in size, and the magnetite in it was cut by the calcite, which indicates that the magnetite formed earlier than the calcite in the same vein. There is also minor amount of pyrite in the vein, and it is surrounded by magnetite. It's worth noting that with the intrusion of the calcite-magnetite vein, Au-mineralization has also developed. There are three kinds of circumstances where native gold could be found: First, gold is located in the boundary of the calcite and magnetite; second, gold is in the calcite; third, gold is enveloped in the pyrites. The gold is usually about 10um in size Focus on this vein is of great significance to the gold exploration in this district.

References

Zhang, Y., Li X., Zhang, J. The Haladala Plutonic suite and its tectonic background. Xinjiang Geology, 2000. Vol. 18(3). P. 258–263.

Xue, Y,. Zhu, Y. Zircon SHRIMP chronology and geochemistry of the Haladala gabbro in southwestern Tianshan Mountains // Acta Petrologica Sinica, 2009. Vol. 25(6). P. 1353–1363.

E.A. Ivleva, N.T. Pak
Institute of geology NAS of the Kyrgyz Republic, Bishkek
paknikolay50@mail.ru

THE BIGGEST RARE-EARTH DEPOSITS IN TIEN SHAN

Приводятся данные о геологическом строении и минералогии крупнейших месторождений редкоземельных элементов Куттесай-II (80% добычи РЗЭ в Советском Союзе) и Сарасай. Месторождения представлены зонами гидротермально-метасоматической проработки, связан-

ной с магматизмом пермского возраста. Локализация месторождений определяется тектоническим строением. Основными концентраторами РЗЭ могут быть собственные минералы – ксенотим, монацит, бастнезит и др. карбонаты с определенной ролью в балансе РЗЭ флюорита и силикатов циркония и тория (Куттесай-II), на месторождении Сарысай главная роль принадлежит пирохлору с включениями собственных РЗЭ-минералов, а также гипергенных оксидов марганца с сорбированными РЗЭ.

The Tien Shan fold system is the largest rare earth and rare metal province in the Central Asia. A number of rare earths deposits and occurrences are concentrated in the territory of the Kyrgyz Republic. The most of them are related to the Permian intrusive magmatism.

The Kuttesai-II deposit. About 80 % of rare-earth elements in the Soviet Union were mined and extracted from this deposit, which has no analogues in the world. The deposit is composed of gneisses of the Early Proterozoic (?) Aktuz Formation and amphibole schists of the Middle Riphean (?) Kuperlisai Formation. The Riphean mafic and ultramafic rocks, Late Ordovician to Silurian granodiorites and leucocratic granites, Permian to Triassic monzodiorites, syenites, subalkali leucogranites, granophyres, lamprophyres, diorites, and diabase porphyrites intrude the metamorphic rocks.

The rare-earth mineralization from the Kuttesai deposit is a result of intense metasomatic processes associated with intrusion of the Permian granophyres (Fig. 1). The orebodies consist of me

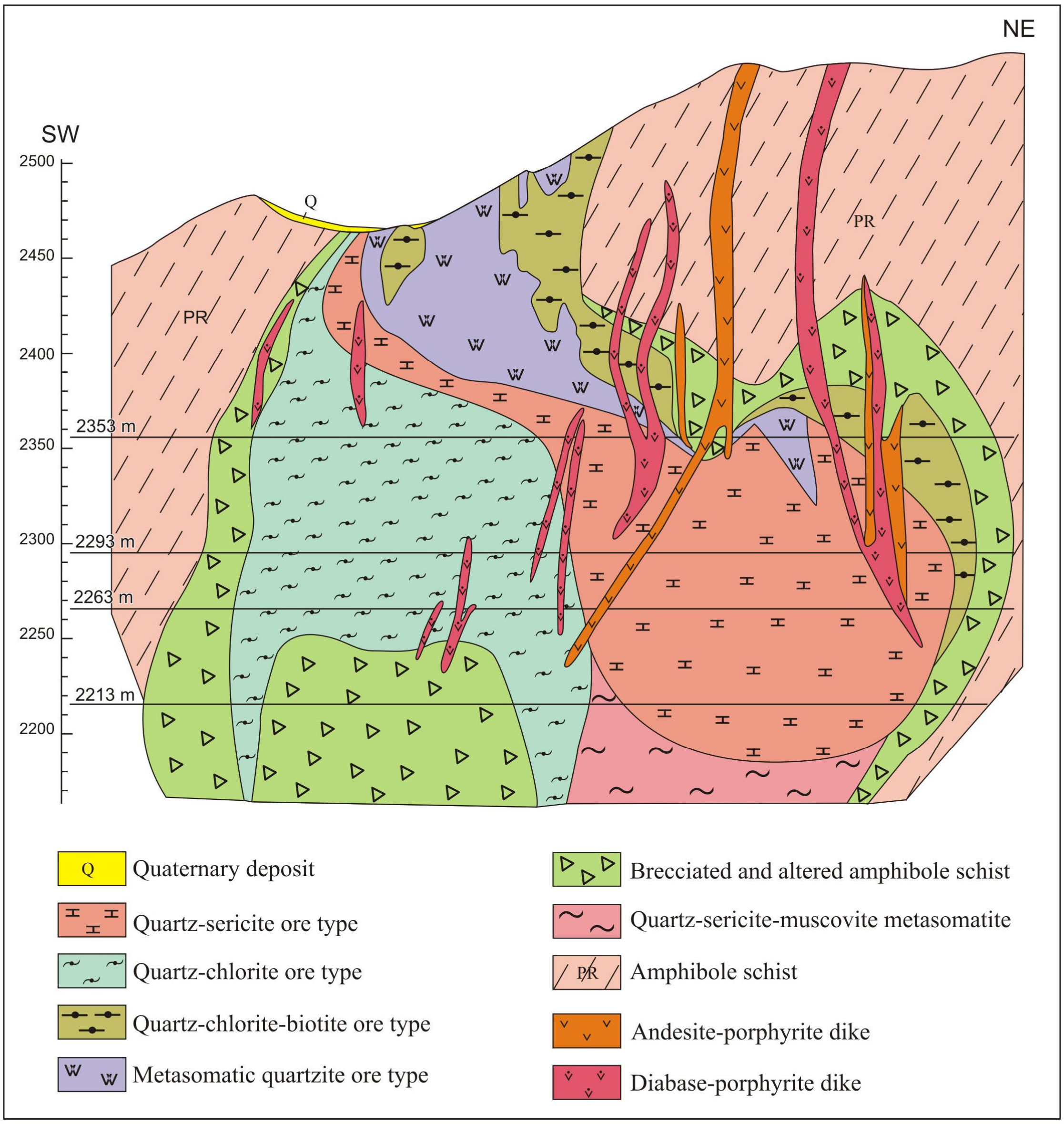

Fig. 1. Model of zoning for the Kutessai-II deposit.

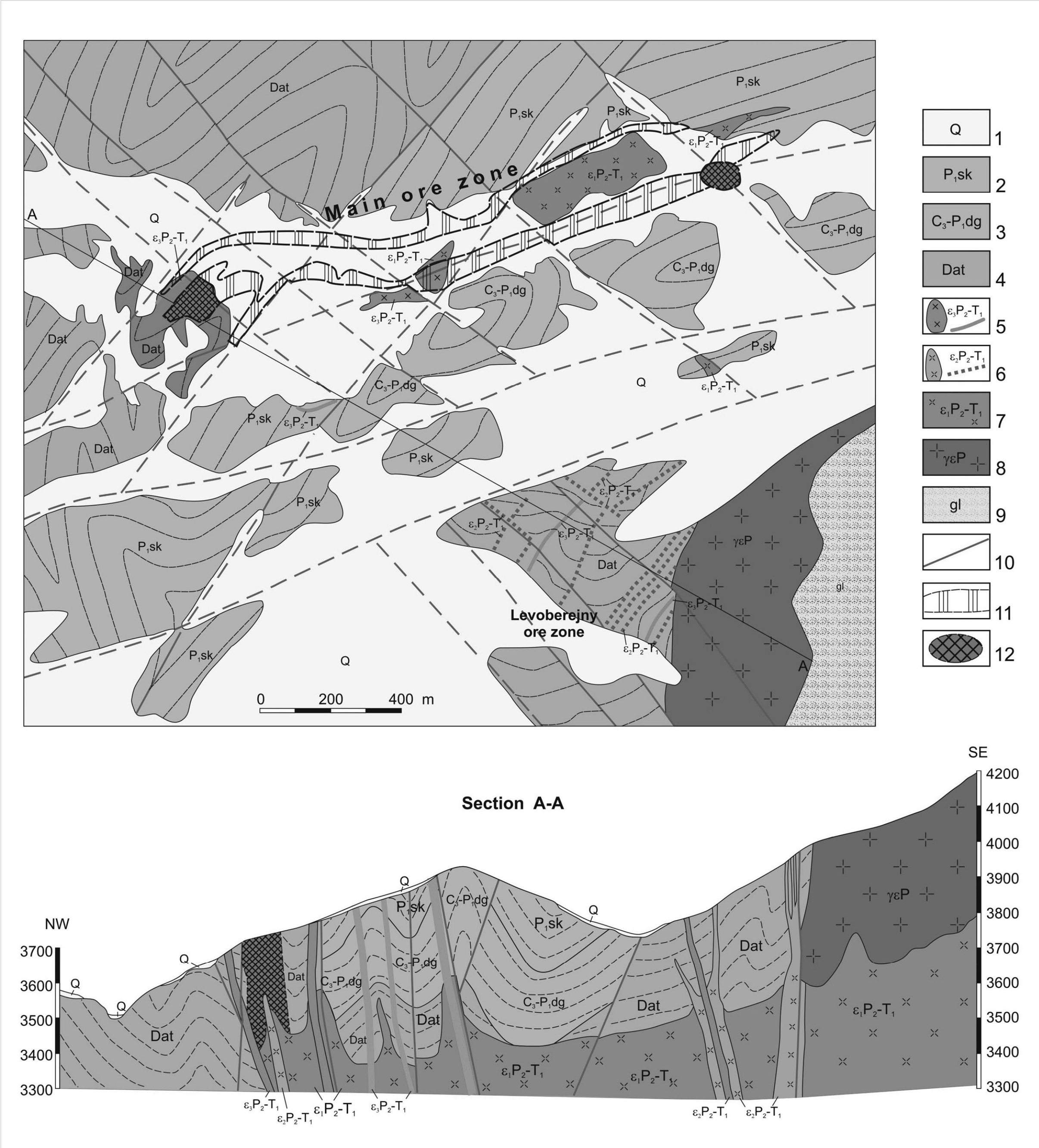

Fig. 2. The geologic map of the Sarysai deposit.

Quaternary sediments (1), Lower Permian shale, conglomerate, limestone, olistostromes (2), Upper Carboniferous to Lower Permian limestone, marble (3), Devonian siltstone, shale with interlayers of sandy limestone (4), Late Permian intrusive rocks of the Surteke complex (5–7): carbonatite of third phase (5), fine- to medium-grained alkali and nepheline syenite of the second phase (6), medium- and coarse-grained alkali syenite of the Kaichin pluton and its apophysises of the first phase (7), Early Permian rapakivi granite and syenite of the Dzhangar complex (8), glaciers (9), faults (10), ore zones (11), orebodies (12).

tasomatic rocks and eight zonal ore mineral types depend on metasomatic alterations: quartz-chlorite, quartz-sericite, altered granophyres, biotite hornfelns, altered amphibole schists, metasomatites after gneisses, and quartz-sericite-muscovite (greisen) and silicified rocks [Kim, 1965]. The carbonate-phosphate, carbonate-silicate, and silicate rare-earth ores are dominant at the upper, intermediate, and lower levels of the deposit, respectively.

Monazite, fluocerite, xenotime, yttroparisite, bastanaesite-(Y), cyrtolite, ferrithorite, and yttrofluorite, which are present in various proportions, are major minerals-concentrators of Y, La, Ce, Nd, Pr, Dy, Sm, and Gd in all ore types. In spite of considerable amount of cyrtolite, ferrithorite, and yttrofluorite, they are of secondary importance.

The Sarysai tantalum-niobium-rare-earth deposit is an example of ore mineralization hosted in carbonatites related to syenites. The deposit is composed of the Devonian, Carboniferous, and Permian terrigenous-carbonate sedimentary rocks. The intrusive rocks include Early Permian granites, rapakivi granites, and Late Permian alkali rocks of the Kaichin intrusive pluton, whose satellite, the Sarysai intrusive body, hosts Ta-Ni and rare-earth mineralization (Fig. 2). The latter is composed of the rocks of three consecutive phases of alkali magmatism: lujavrites and pulaskites of the first phase, leucocratic alkali syenites of the second phase, and intrusive aegirine-calcite carbonatites of the third phase. The veins of metasomatic carbonatites branch from the Sarysai stock.

All three stages underwent ore-bearing metasomatism and autometasomatism, which led to formation of fenites, albitites, and carbonate metasomatic rocks. The ore metasomatites of all stages form the combined ore zones.

The content of rare earth elements in metasomatites are 0.01–0.05 % for Yb and about 0.05 % for each of Ce, La, Y, and Nb. The Nb/Ta, ΣREE/Y, and Y_2O_5/TR_2O_5 ratios in different ore bodies are approximately 10:1, 4:1, and up to 1:4, respectively.

The quartz-feldspar-aegirine ore veins are zonal: the central parts include leucocratic fenites, rarely with aegirine, and the marginal parts are composed of carbonatites with variable content of calcite. The aegirine-amphibole-feldspar metasomatites are the intermediate varieties. All of them are the products of metasomatic facies of the carbonatite process. The radioactive pyrochlore (hatchettolite), euxenite, xenotime, rare earth carbonates and products of their alteration, ilmenorutile, zircon, and thorite are economically valuable minerals. Sulfides include galena, pyrite, pyrrhotite, and molybdenite. Supergene minerals are iron and manganese hydroxides.

According to the geologic position, ore-bearing metasomatites, and ore mineralization, the closest analogues of the Sarysai deposit are the deposits of the carbonatite-related aegirine-albite type with hatchettolite and zircon [Solodov, 1987]. The high content of Y group elements is untypical of this type of the deposits. Probably, this is caused by involvement in ore formation both of carbonatites (intrusive and metasomatic), syenites, and derivatives of the granite magma.

References

Kim, V.F. Features of the internal structure, forming and distribution of rare-metallic mineralization at the Kutessai-II deposit // Candidate Dissertation in Geology. Frunze, 1965. [in Russian].

Solodov, N.A. etc. The geologic reference book for high-gravity lithophile rare metals. Moscow, Nedra, 1987. 121 p. [in Russian].

V.V. Maslennikov [1, 2], V.A. Simonov [3], N.S. Ankusheva [1,2], S.P. Maslennikova [1], C.T.S. Little [4], B. Buschmann [5], L.V. Danyushevskiy [6], B. Spiro [4]

[1]Institute of Mineralogy UB RAS, Miass, Russia, mas@mineralogy.ru

[2]National Research South Ural State University, Chelyabinsk, Russia

[3]Institute of Geology and Mineralogy SB RAS, Novosibirsk, Russia

[4] Natural History of Museum, London, UK

[5] TU Bergakademie Freiberg, Cermany

[6] CODES, University of Tasmania, Hobart, Australia

HYDROTHERMAL VENT FAUNA IN THE URALS VMS DEPOSITS: CRITERIA FOR OCCURRENCE

Рассмотрены критерии появления, фоссилизации и сохранности пригидротермальной фауны в рудах колчеданных месторождений Урала и других колчеданоносных регионов. Показано, что для появления фауны благоприятными являются колчеданообразующие системы черных курильщиков, формировавшихся на базальтовом и риолит-базальтовом основаниях. Установлено, что черные курильщики, обогащенные Fe, Sn, Te,Co являются спутниками сульфид-