

Notes and Comments

A note on newly found ore fields in Govi-Altai area, southern Mongolia

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Abstract: In the Govi-Altai area with a dimension of 3000 km², many mineral occurrences have been confirmed. Within the Erdene sum eleven hydrothermal ore fields exist and vein-type and skarn occurrences, with slight gold anomaly in some places, have been found. Representative ore fields are the Shaart Bulag, Galuutiin, and Tsetseg nuur. In the Biger sum many Cu anomalies have been detected.

1. Introduction

Through the ITIT and JICA-IGMR Projects, geological collaboration between the Geological Survey of Japan and Mongolian institutions have fruitfully grown and progressed. Especially attention have been paid on prosperous regions, and geology staves of MONGOLYN ALT Co., Ltd. have closely exchanged opinions with geologists at the JICA-IGMR Project on exploration in the Govi-Altai area. This time we have investigated some prosperous parts in the Govi-Altai area for 3000 km², southern Mongolia (Fig. 1). The investigation was carried out in the Erdene, Biger and Chandman sum. Each sum (Mongolian political unit like Japanese prefecture) is connected by dirt roads and is equipped with telephone and coal-heating

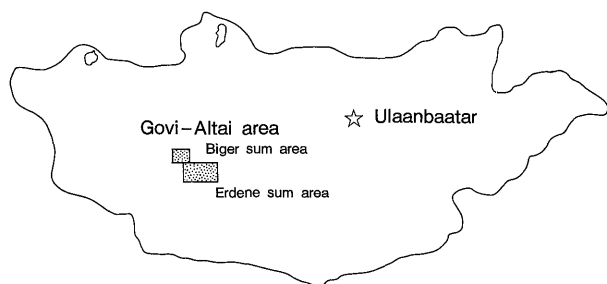


Fig. 1 Location map of the study area.

system. In addition, a coal mine in the center of the study area assures the constant supply of coal for heating. In this note we report the preliminary result of the investigation to base future exploration in the Govi-Altai region.

2. Geologic setting

The Govi-Altai area is divided into two belts, Mongol Altai belt and Marine belt. The Mongol Altai belt extends from east to west and has isoclinal structure. The belt is composed of Upper Riphean "Gegeetyn Formation", Middle Cambrian-Lower Ordovician "Ukhaanuurn Formation" and Lowe Devonian "Gichigny (Gichgnii) Formation". Devonian intrusive rocks are also found in the Mongol-Altai belt. The Gegeetiin Formation of ca. 800-m thickness consists of metabasalt, andesite, siltstone, tuff, amphibolite, epidote-amphibolite, garnet-epidote-amphibolite, green schist, sericite schist and minor dacite and rhyolite. The Ukhaanuurn Formation is composed of tuffaceous siltstone, tuffaceous sandstone, felsic tuff, siltstone, sandstone, phyllite, sericite schist and limestone. The thickness is ca. 1700 m. The Togrogyn Formation includes basalt, diabase, andesite-basalt and felsic to basic tuffs. At the top of the section, andesite-dacite, rhyolite, chlorite schist, chlorite-sericite schist, sericite schist and phyllite occur. Close to the bottom of the section, amphibolite and gneiss are predominant. The Gichigny Formation is the dominant unit in the study area and is composed of sandstone, siltstone, clayey schist,

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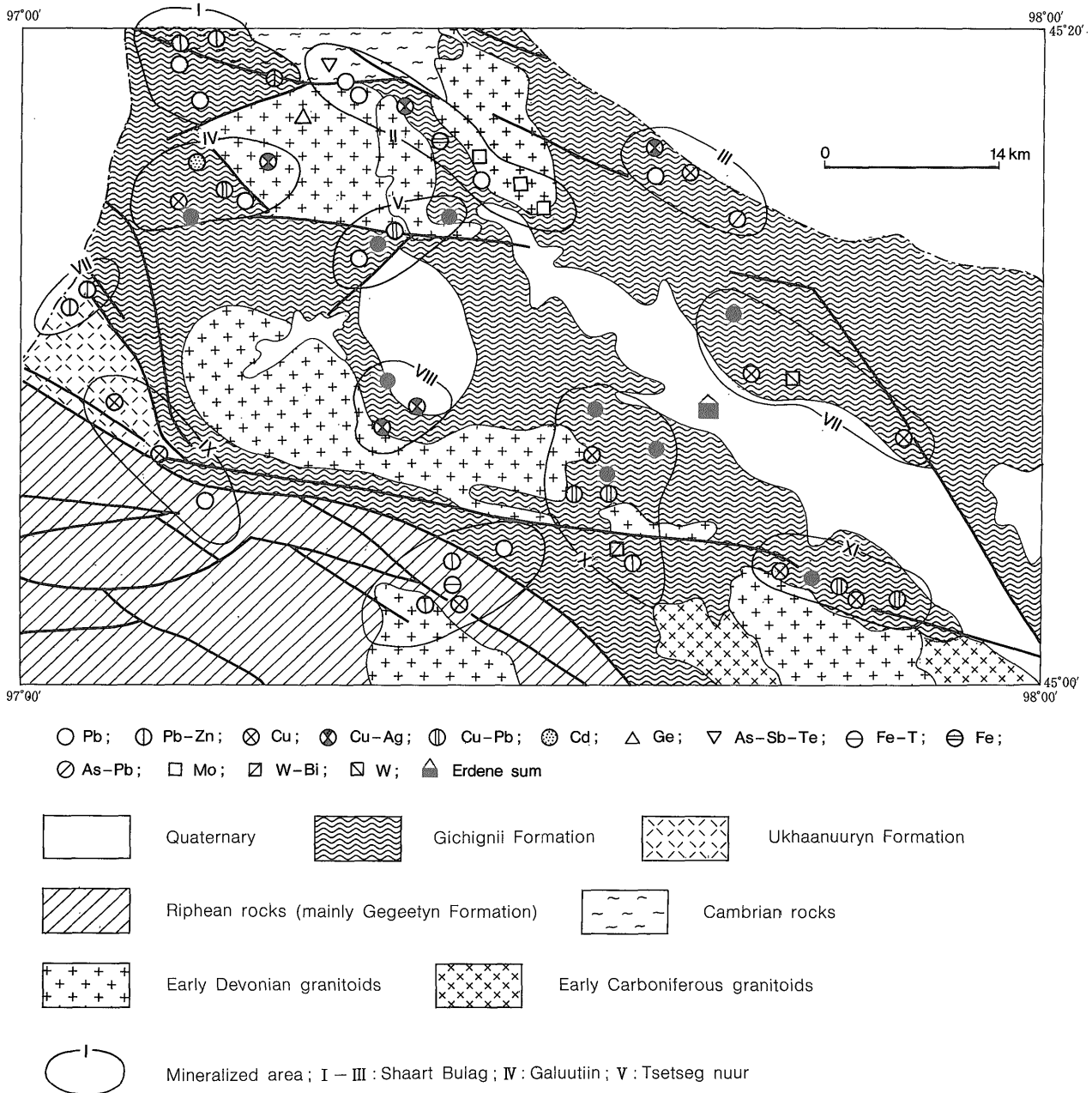


Fig. 2 Geology of the Erdene sum, Govi-Altai, southern Mongolia.

sandstone basalt, andesite basalt, basic tuff, dacite, grit, conglomerate, micaceous schist and marble. The thickness is approximately 2100 m. All of the above-mentioned rocks are penetrated by intrusive rocks such as middle to coarse-grained plagiogranite, tonalite and granodiorite. These are considered to be of Early Devonian in age. Sometimes at the exocontact of intrusives skarn and magnetite aggregate are noticed.

Within the Marine belt, ophiolite complex of possibly Riphean time is distributed along faults. Predominant members of the complex are effusive rocks and ultrabasic rocks. In addition to the complex, following formations are distributed in the belt. (1) Middle Cambrian "Ulaan-Shandiin" Formation; (2) Lower-Middle Devonian "Gichigny" Formation; (3) Middle-

Upper Carboniferous "Huren Golyn" Formation; (4) Middle Permian "Delgerkhangain" Formation; (5) Upper Jurassic-Lower Cretaceous "Ondor Ukhaagiin" Formation; and (6) Lower Cretaceous "Khulsan Golyn" Formation. The Ulaan-Shandiin Formation consists of basalt, andesite-basalt, tuffaceous sandstone, conglomerate and limestone. These rocks are intruded by Middle-Late Cambrian and Permian igneous rocks. Skarn is formed at the contact between these intrusive rocks and limestone. The Gichigny Formation consists of sandstone, siltstone, conglomerate and limestone. The thickness is estimated to be 500 m. The age of this formation was determined by a flora at the top of the section. The Huren Golyn Formation is composed of siltstone, sandstone, grit, conglomerate

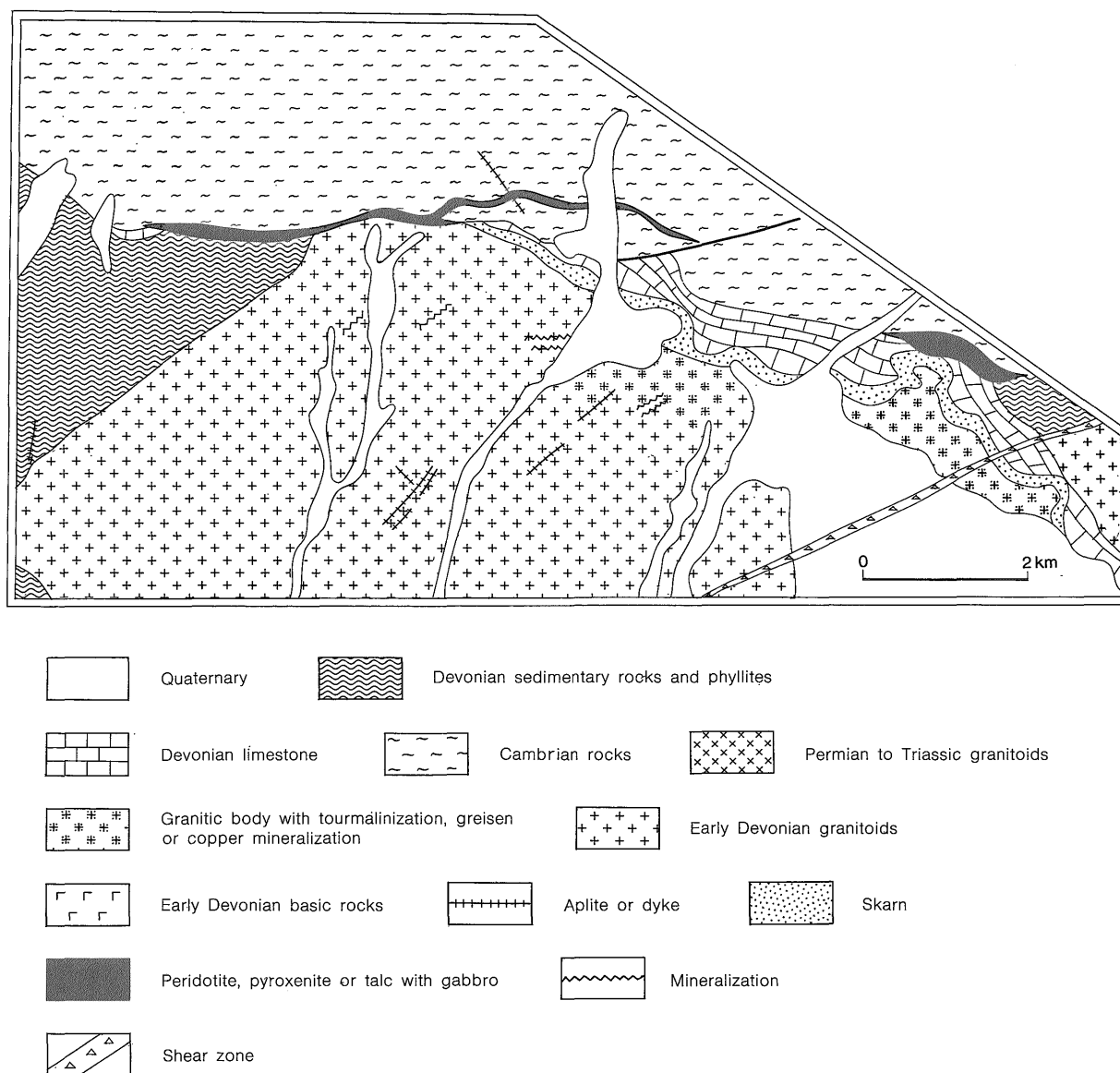


Fig. 3 Geology and mineralization at Shaart Bulag ore field, Erdene sum.

and coal seam. The age of the sediments were well determined by a flora in the formation. The approximate thickness is 700 m. The Delgerkhangain Formation includes trachybasalt, basalt, ignimbrite, lava, and trachdacite. Felsic and intermediate lava, tuffaceous sandstone and tuffaceous siltstone are also noticed. Conglomerate, sandstone and coal seam are distributed in the uppermost portion of the section.

3. Mineralization

3.1 Erdene sum area

Three types of deposit are known for the study area at present. They are of skarn, hydrothermal vein and porphyry copper mineralization. In the Gobi-Altai area,

more than ten skarns, more than one hundred quartz veins and more than fifty porphyry copper occurrences have been found. In addition, four places were identified as gold alluvial deposits. The study area is divided into the Erdene sum and Biger sum areas.

The Erdene sum area is covered with Riphean metabasalt, metaporphyrite, altered siltstone, tuff, amphibolite, Cambrian-Ordovician tuff, Lower Devonian siltstone, sandstone, clayey schist, limestone, basalt, andesite and dacite (Fig. 2). Granitic rocks of Early Devonian time is also distributed. In the sum following mineral occurrences have been found.

(1) *Shaart Bulag ore field I*: quartz and quartz-carbonate veins in siltstone, argillite and chlorite schist of Devonian age. The mineralized area has a dimension

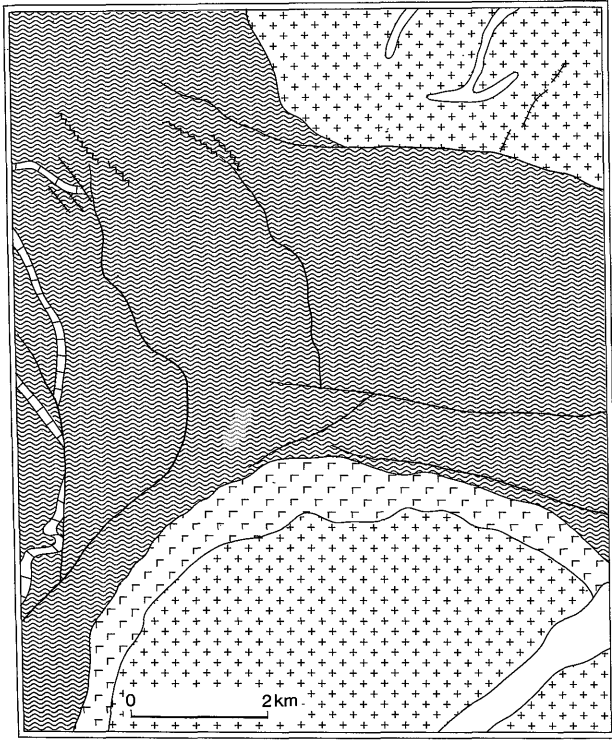


Fig. 4 Geology and mineralization at Galuutiin ore field, Erdene sum.
Legends, see Fig. 3.

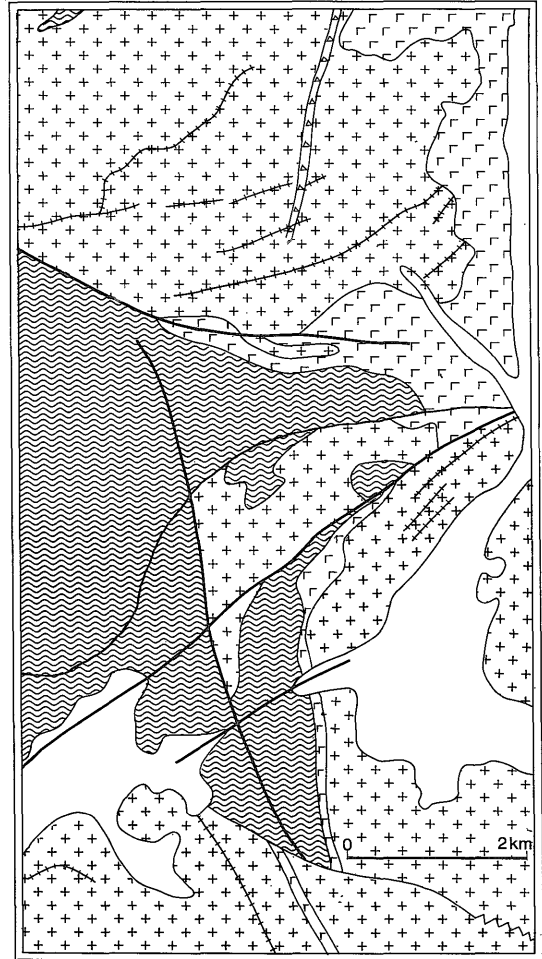


Fig. 5 Geology and mineralization at Tsetseg nuur ore field, Erdene sum.
Legends, see Fig. 3.



Fig. 6 Geology and mineralization at Sagsai gol occurrence, Erdene sum.
Legends, see Fig. 3.

of 3.6 km² (I of Fig. 2 and Fig. 3). Pyrite, chalcopyrite, and galena are seen in the veins. According to the emission spectrography of flame source, vein samples contain 1 % Zn, 2-3 % Pb, 20-30 g/t Ag, 0.4% Cu, 30 g/t Cd, 0.03 % As, 6g/t Au, 30g/t He, and 0.003 % Sn.

(2) *Shaart Bulag ore field II*: Garnet and garnet-magnetite-epidote skarn at the contact between Devonian limestone and granosyanite within an area of 8.5 km² (II of Fig. 2 and Fig. 3). Limestone is usually mylonitized and shows siderite alteration and silicification. As ore minerals, chalcopyrite, galena, pyrite, and sphalerite are identified. Result of the emission spectrochemical analysis is: Cu 1 %; Zn, 2 %; Pb, 0.3 %; Cd, 30-50 g/t; As, 0.01 %; Sn, 0.01 %; Ag, 20 g/t; Au, 0.01-0.2 g/t, Hf, 30 g/t; W, 0.01 %; Ge, 30 g/t; He, 5 g/t; Mo, 0.01 %; and Bi, 0.03 %.

(3) *Shaart Bulag ore field III*: Quartz-tourmaline-sulfide vein in granodiorite. The mineralization is recognized within an area of 4.8 km² (III of Fig. 2). The width of veins ranges from 20 to 70 m and the length is ca. 0.7 km. Result of the emission spectrochemistry is: Cu, 5-6 %; Pb, 0.03 %; Zn, 0.04 %; Ag, 20 g/t; Mo,

0.006 %; Au, 0.02 %; and Cd, 50 g/t.

(4) *Galvutiin ore field*: quartz veins in granite-gabbro-sandstone region of 7.5 km² dimension (IV of Fig. 2 and Fig. 4). Pyrite, chalcopyrite, azurite and malachite are common in veins. Emission spectrochemical analysis of channel samples revealed that veins contain 0.1-0.8 % Cu, 0.5 % Zn, 0.14 % Pb, 3-100 g/t Ag, 0.01-0.3 g/t Au, 0.1 % Sb, 0.003-0.02 % As and 0.01 % Cd.

(5) *Tsetseg nuur ore field*: various kinds of quartz veins and veinlets are existed together with stockwork in the center of gabbro, and at the contact between gabbro, sandstone and Permian granitic rock. The mineralized zone is 4.5 km² (V of Fig. 2 and Fig. 5). Channel samples showed an average value of 0.06-0.1 % Cu, 0.2 % Zn, 0.5-0.6 % Pb, 5-6 g/t Ag, 3-20 g/t Au, 0.01-0.03 % As, 60 g/t Nb, 50 g/t Y and 10 g/t Cd.

(6) *Sagsai gol occurrence*: quartz veins in Devonian siltstone within 1.5 km² (V-18 of Fig. 2 and Fig. 6). The vein thickness is 1 to 2 m. Pb, 0.1 %; Zn, 0.2 %; Ag, 2 g/t; As, 0.004 %; Au, 0.5 g/t; Hg, 0.02 %.

3. 2 Biger sum area

The Biger sum area is characterized by Cu anomaly in many places and strong hydrothermal alteration. Occurrences are expressed with the letter B and the following number, like B12. The Cu anomaly is derived from several types of mineralization as will be stated below.

(1) B12 Occurrence: a granosyenite-aplite body shows Cu anomaly. The body is 180 m wide and strikes about 4 km. Information from two drill holes was used to calculate the ore reserve, 18.7 million tonnes of ore and 56,000 tonnes of Cu. Emission spectrography gave average metal contents as follows: Cu, 0.5-0.8 %; Mo, 0.005-0.01 %; Ag, 0.5-3 g/t; and Au, 0.02 g/t.

(2) B4, 6 and 11 occurrences: the ore body is altered trachydacite and has a dimension of 2.5 km by 2-5 m. The alteration is either potassic alteration or chloritization. Chalcopyrite is predominant; chalcocite and bornite are also noticed. Cu, 0.1-3 %; Mo, 0.0005-0.006 %; W, 0.002-0.01 %; Pb, 0.15 %; Zn, 0.04-0.06 %; Ag, 0.5-20 g/t, Au, 0.008-0.15 g/t.

(3) B16 occurrence: quartz-carbonate-chlorite veins and stockwork occur within granite porphyry of which

diameter is ca. 1 km. Potassic alteration of the host rock is strong. Channel samples gave an average metal content as follows. 0.02-15 % Cu, 0.0005-0.001 % Mo, 0.001-0.15 % Zn, 0.2-100 g/t Ag, 0.003-0.02 g/t Au.

4. Concluding remarks

Based on our work, many prosperous occurrences were identified in the Govi-Altai region. Although metallic anomalies were detected by emission spectrochemical analyses⁺ as mentioned above, the occurrence mode of each metal and mineral assemblages have not been studied. Further petrographic study and other experiments are necessary to establish exploration models in this region.

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Appendix : Sensitivity of emission spectrography used in this work

	Evaporation method		Spill injection method	
	lower (ppm)	upper (%)	lower (ppm)	upper (%)
Cu	1	1	2	1
Pb	2	1	2	1
Zn	20	1	10	1
Ag	0.1	0.0001	0.1	0.0001
Sb	20	1	20	1
As	100	1	20	1
Cd	10	1	2	1
Nb	5	1	7	1
Ta	70	1	100	1
Y	3	1	10	1
Mo	1	1	1	1
Bi	2	1	1	1
W	5	1	3	1
Sn	3	1	1	1

⁺Detection limit of elements, see the Appendix.

モンゴル国南部ゴビ-アルタイ地域で発見された鉱徴地について

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要 旨

モンゴル国南部のゴビ-アルタイ地域では近年探査活動が活発に行われている。本資料ではエルデン地区とビゲル地区で発見された鉱徴地について基礎データを掲載した。エルデン地区では10カ所以上に熱水性鉱化作用が観察される。これまでに確認されたのは卑金属を含む石英脈とスカルンで、それらは場所によっては若干の金のアノマリーを示す。代表的な鉱床区はシャートブラッグ、ガルティン、ツェツェッグヌールである。ビゲル地区では銅のアノマリーを示す場所が多い。