CONCERNING HETEROGENEOUS DIAMOND-FORMING GEOSTRUCTURES OF MONGOILA

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Abstract

In this paper we present summation of ten-year investigation of the four heterogeneous diamond-forming geostructures of Mongolia. These geostructures were considered on the example of the Agit Khangay, Khuree Mandal, Bayan Khuree, Tsenkher astropipes, Teel aggradation terrace, Shavariyn Tsaram dome volcano and Khan-Khukhey metamorphic terrane.The our detailed geological and gas-geochemical investigations of the Mongolian astropipe geostructures noticeably show diamondgenesis is the expression of the collision of the lithospheric mantle with meteor impact collaps explosion process. First discovery of the Teel placer diamonds is indicated that transfered diamonds may have accumulated and concentrated in the aggradation above- the-flood plain terraces which are widely spread by the Selenge river basin.

Key words: astropipe, diamond, impact, crater, spherules, meteoritic dust, shatter cone, aggradation terrace, pyrope

I.THE ASTROPIPE GEOSTRUCTURES

According to D.Dorjnamjaa et.al.(1,2) the Agit Khangay, Khuree Mandal, Bayan Khuree, and Tsenkher diamond-forming ring impact astropipe geostructures are established by us for the first time in Mongolia (Fig.1).These astropipe geostructures are wonderfully-preserved from erosion and active denudation, and characterized by both well natural exposures and diversity of different impact-derived and shocked magmatic rocks and minerals.

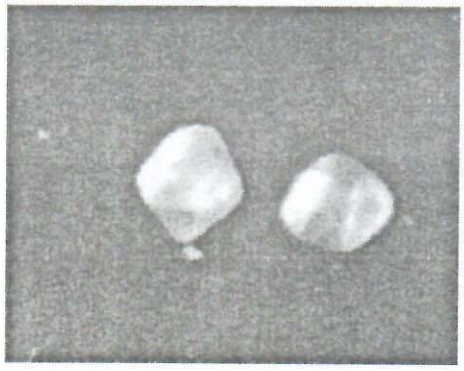
Fig.1. Setting scheme of the diamond-bearing astropipe geostructures of Mongolia

I. Studied astropipe geostructures in 1997-2008
1- Agit Khangay astropipe geostructure
2- Khuree Mandal astropipe geostructure
3- Bayan Khuree astropipe geostructure
4- Tsenkher astropipe geostructure
II. Insufficiently studied diamond-bearing geostructures
5- Possible astropipe geostructure "Round Brown"
6- Neogene "Teel" accumulative valley terrace of Selenge river
7- Shavariyn Tsaram volcanic geostructure

I.1. The Agit Khangay astropipe geostructure(Fig.1;1)

The Agit Khangay astropipe geostructure in western Mongolia was formed at the Permian granite massive. The crater's total diameter is about 10 km and filled with shattered and shocked granite(agizite).Most panned samples and hand specimens contain fine diamonds(Fig.2) of octahedron habit (size of 0,2-0,43 to 2,19 mm; weight of 6,0-6,4 mg or 0,034-0,1 carat), gold (from 0,1 to 3-5 g/t), platinum, moissanite (SiC; size of 0,6 mm), pyrope, rhenium, chrom spinel, kamacite, khangaite (tektite glass-1 to 3 mm in size), picroilmenite, coesite, khamaraevite(TiC), fayalite, sheelite, graphite-2H,etc. Of special interest is a large quantity of the magnetic spherules (meteoritic dust or rain) has been gathered in the region of an Agit Khangay phenomen. These black magnetic balls (from 0,05-0,1 to 1,0-5,0 mm) are characterized by high content of Ti, Fe, Co, Ni, Cu, Mn, Mg, Cd, Ca, Cl, Al, Si, K, Au, etc., and represented by oxides of iron. The spherules(Fig.3) noticeably differ from micrometeorites, but by content of rhenium, khangaite, khamaraevite, and Ir they can be belong to alien planetary substance and, possibly, represent cosmic relics of " Agit Khangay" body.

Fig.2. Pseudo-tetrahedra of diamond(triliing of octahedral) from agizites of Agit Khangay astropipe impact geostructure.



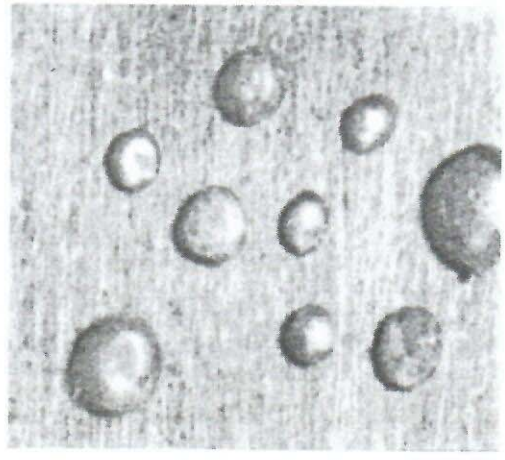


Fig.3. Agit Khangay astropipe. The black magnetic balls or meteoritic dust (size of 0,1 to 5,0 mm).

I.2. The Khuree Mandal astropipe geostructure(Fig.1;2)

The Khuree Mandal astropipe geostructure within the upper Paleozoic volcanic depression (in central Mongolia) in diameter 10 km has an analogous geomorphological position, as an Agit Khangay astropipe crater(1,2). The suevite like rocks (fluidizat) and lavabreccia from various parts of crater and central rise are showed presence of picroilmenite, pyrope, phlogopite, orthite,and gold (from 0,13 to 6,33-32 g/t) closely associated with the mantle and impact fine diamonds (Fig.4; 0,1-0,5 to 2-5 mm in size). So- called shatter cones we produced when the shock wave traversed the Permian volcanogenic rocks. These were first described by us in connection with the Khuree Mandal and Tsenkher astropipe geostructures (1). Meanwhile, shatter cones are known from many meteorite craters on Earth as being typical of impacts(2)

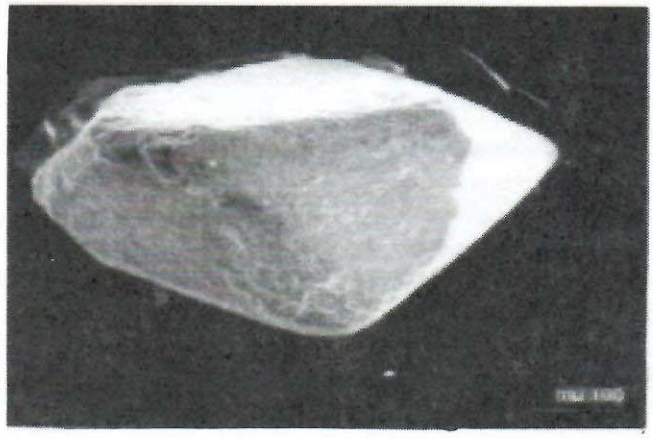
Fig.4. Shatter cone texture or cone-in-cone (size approx. 1,0 m) from the khureemaral basic lava flow of Khuree Mandal astropipe. JPS: 46°31'50"; 98°20'04". Photo of Ts. Amarsaikhan

Fig.5. Diamond octahedron from Khuree Mandal astropipe. The size of crystals is 0,1-5,0 mm.

I.3. The Bayan Khuree astropipe geostructure (Fig.1;3)

The Bayan Khuree astropipe geostructure in south-eastern Mongolia is located in Mesoproterozoic mica schists and impact crater incised into folded country rocks and is covered by Quaternary eolian sands and Cretaceous sediments. The clastic cement of the allogenic breccias contains an impact glass (3-5 mm), shocked quartz grains, pyrope, olivine, chrom diopside and microdiamonds (Fig.6 ; 0,5 x 0,4 mm in size) of composite astropipe-mantle genesis(1,2).

Fig.6. Octahedron of diamond from Bayan Khuree astropipe. The size of the crystal is 0,5-0,4 mm (2).



I.4. The Tsenkher astropipe geostructure (Fig.1; 4)

The Tsenkher astropipe geostructure in southern Mongolia, at the south-eastern edge of NW-SE trending mountain renge, the Edrengyin Nuruu is located on a basin fill which is gently dipping to the south. The geostructure's diameter is about 7,3 kilometers, and it is surrounded by raised rim and relatively well-preserved ejecta blanket-like materials. The region is dominated by the Altay Mountain Renges which are primarily Silurian-Devonian island-arc and continental Mesozoic-Cenozoic platform assemblages.The panned sample contains an impact glass, pyrope, olivine, gold and moissanite . We have been able to reveal and describe the shatter cones from volcaniclastics within the NW part of raised rim(2).

The adsorbed form of gas in the Mongolian astropipe impactites (Agit Khangay-sample 32/99, Khuree Mandal-sample 58/03, Bayan Khuree- sample 17/03) has been compared with gases of analogous form in volcanic rocks of modern (Volcano Gorelii, Kamchatka) and ancient (Maikhant-sample 25/04 and Zuun Busluur-sample 36/04, volcanoes, Dariganga plateau, Mongolia) eruption and kimberlite pipes (Victory-1, Shandun province, China). This gas-geochemical investigation has been done by L.S.Kondratov and D.M.Voinkov in Moscow VNIIGeosystem laboratory (2).

Fig.7. Shatter cone texture(size approx. 15,0 cm) from Devonian volcaniclastics of Tsenkher astropipe. JPS: 43°37'; 98°20' (from D.Dorjnamjaa et.al.,2008).

II. THE TEEL DIAMONDIFEROUS AGGRADATION TERRACE

The Teel aggradation terrace is located at the left edge of the Selenge river, at the pedestal of mountain Namnan uul (Fig.8). The Teel terrace is those whose cusp and bench entirely composed of alluvial sediments.

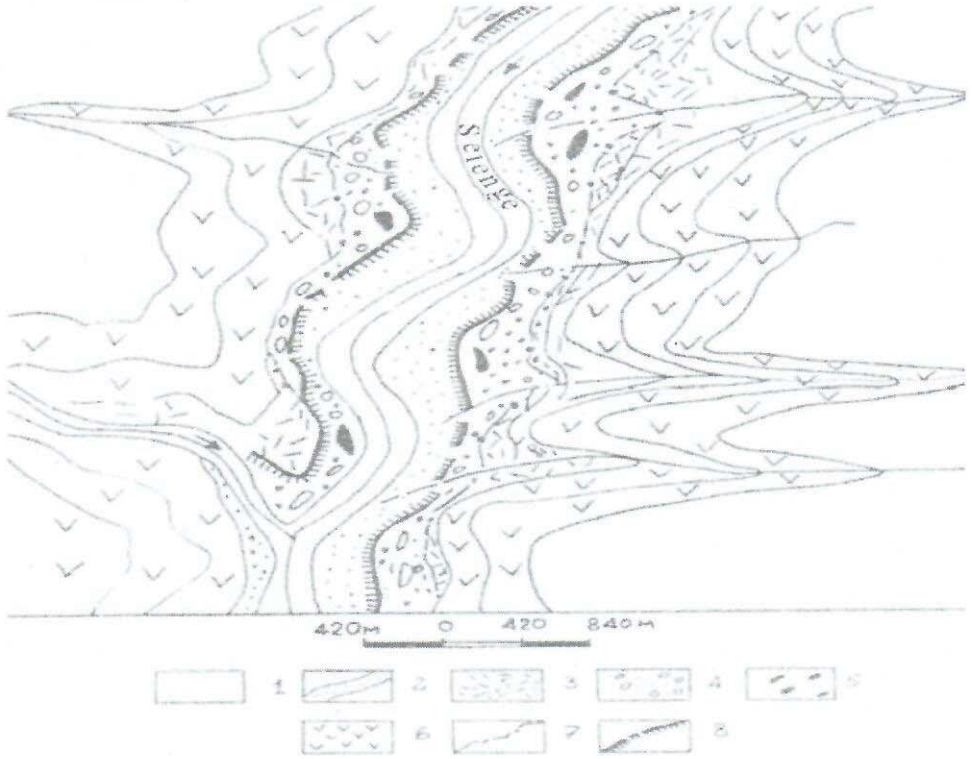
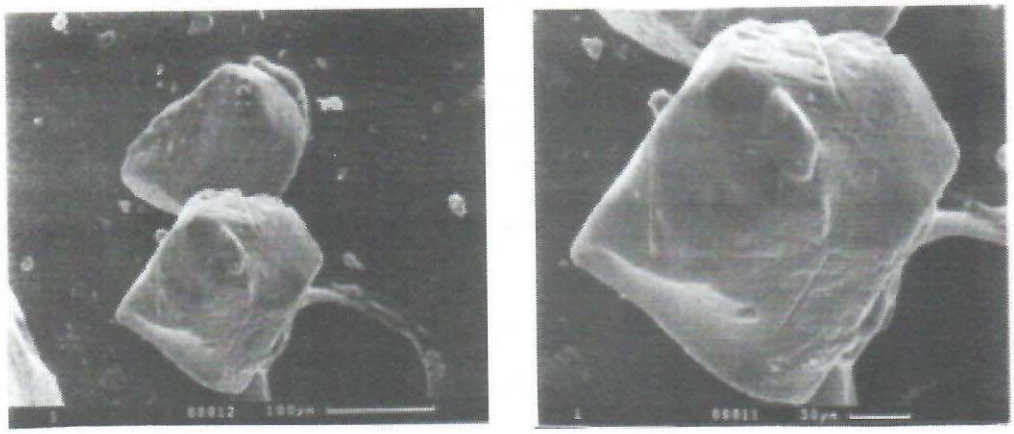


Fig.8. Setting scheme of the some Middle Pleistocene aggradation terraces by the Selenge river basin.

1-main channel; 2-flood-plain alluvium; 3- sands and sandy psammitic rocks on the alluvial terraces; 4-coarse-fragmental rocks composing terraces; 5-flood-plain bench with cosmic spherules, microdiamonds, garnet, coesite, tektite glass,etc.; 6-sites of the Permian volcanogenic and volcanosedimentary rocks; 7- terrace's boundary; 8- cusp of the aggradation terraces.

Common terrace plain is up to 6 km long and 200-500 metres wide. The maximum height of 60-70 metres, up to 90 metres in Selenge river terraces. The thickness of detrital rocks of the first above-the-flood-plain terrace attain of 18 to 20 metres. This flood-plain accumulative formation is composed mainly of detrital sedimentary: coarse-fragmental psephitic (~40%) and sandy psammitic (~60%) rocks. Typical feature of the alluvial detrital sedimentary is horizontal and diagonal bedding. Boulders, shingles, pebbles occur much more often among detrital rocks. Within the Teel aggradation terrace we have been able to reveal microdiamonds, corundum, cosmic spherules, rutile, olivine, diopside, garnet (pyrope), coesite, green and yellow spinel, khangaite, etc. Diamond microcrystals (0,2 mm in size) were extracted from several small panned samples (from 30 to 45 kg). The colour of grains is mainly light-yellow, seldom gray, white, etc.(2)



a b

Fig.9. Irregular growths of diamond cubes and a fragment of one of them (a-b) from Middle Pleistocene Teel placer Mongolia. The size of grain is 0,18-0,2 mm.

III.THE SHAVARIYN TSARAM DOME VOLCANO

This geostructure is located some 120 km NW of Tsetserleg city, 18 km southwest of Tariat sum and lies within the Terkhiin Tsagaan Nuur closed depression. The examined dome volcano has an oval form up to 1300 x 700m plane and made up of compacted and mixed clay with clasts of basalt , sedimentary ,and metamorphic rocks and various minerals. These rocks contain dark alloclastic and eruptive breccias which characterized by composition of kali-alkali basalt with clastogene porphyry-like structure. For the first time Yu.O.Lipovskii, T.Namsrai and other geologists have revealed olivine-bearing basalt in this area in 1973. Microdiamonds (12 grains, 0,1-0,2 mm in size, weight of 0,67 mg) have been discovered in the pyrope-bearing basalt as a result of detailed analytical study of this basaltic dome volcano by Mongolian and Russian geologists. The analogous Pleistocene volcanic geostructures of explosive type, famous Dariganga plateau basalts have to be considerable perspective for new diamond-forming geostructure in the future (2).

IV.THE KHAN-KHUKHEY METAMORPHIC GEOSTRUCTURE

This geostructure lies within the Tuva-Mongolian intermediate massif, in the interfluve Baruunturuun and Khangiltsig and some 170 km distant south-east from Ulaangom city. The Precambrian outcrops are part of a series of ancient blocks that form single Khan-Khukhey-Songino Precambrian massif modified by late Precambrian and early Paleozoic deformation. The central part of the metamorphic block or terrane consists of the baruunturuun and khangiltsig complexes. These complexes made up of granulite, garnet-biotite schist, graphitic marble, sedimentary quartzite, and gneiss with kyanite and sillimanite. By our recommendation (2) T.Namsrai and L.Lavrova from Moscow(CNIGRI) have found some microdiamonds in these metamorphic rocks in 1992-1993. Microdiamonds of 0,1 to 0,05 mm in size (about 40 grains) are found in the garnet-bearing biotite gneisses with graphite and graphitic marble, and pyroxene metasomatite (2). The recognition of diamond in the Khan-Khukhey metamorphic terrane indicates that old continental rocks might heve been metamorphosed at higher pressure more than 40 kbar. The analogous to Khan-Khukhey old Precambrian metamorphic terranes, for example, the Dariv, Uench-Bodonch, Baidrag, and other geostructures may contain diamondiferous UHPM minerals.

Summing up the set forth new material let us note some of fundamental aspectes of the problem. In accordance with V.N.Kvasnitsa and N.N.Zintchouk (3), we can conclude that diamond is a polygenous mineral which is formed not only in conditions of the earth's bowels, but at super-velocity collision of space bodies, as well as during the processes of gas condensation in interstellar space. The essence of the phenomenon is mantle manifestation and plume of the combined nuclear-magma-palingenesis interaction.

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