Review Article

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Concerning the Microdiamonds and Cosmic Spherules from Middle Pleistocene Selenge River Basin in North Mongolia

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Introduction

This paper concerns deals with new discovery of microdiamonds and cosmic spherules from Middle Pleistocene Selenge river basin by the example of the Teel and Khukh Ereg terrace alluvial terraces. The Teel and Khukh Ereg alluvial terraces are located at the north and south edges of the Selenge river (Fig.1), at the base of mountain Namnan uul (Fig.2). These terraces are those whose cusp and bench entirely composed of alluvial sediments of Middle Pleistocene age [1]. This indicates that the Selenge river has a long history of development, had time to develop a flood plain and to deposit alluvium, through which it cut subsequently and north and south behind as a Teel and Khukh Ereg terraces [2]. Alluvium studies may be of great practical interest because in some areas, river terraces are veritable treasure-troves of economic minerals. With river terraces are associated most placer deposits of such important economic minerals as gold, platinum, diamond, etc. Numerous engineering projects, an example, bridges (Kherlen, Tuul, Selenge, Orkhon, Baidrag, Tui, Zavkhan, Delger Muren, etc.), dams and hydropower plants (Durgun Nuur, Ulaan Boom) are built on alluvial deposits. Hence the need to know all the essential features of the geostructure of river terraces. Just our investigation of the Selenge river terraces in 2006-2010 and 2014 gave possibility to discover the placer diamonds within the Teel and Khukh Ereg alluvial terraces for the first time in Mongolia [3,4].

Keywords: Microdiamonds, Cosmic spherules, Alluvial terraces, Tektite glass

Figure 1: Location of the placer microdiamonds and cosmic spherules from the alluvial sediments of Selenge river in North Mongolia (*1)

Main Results

Common terrace plain is up to 8 kilometres long and 300-600 meters wide (Fig.2). Maximum height of terraces is 60-70 meters, up to 120 meters in the Selenge river. The thickness of detrital rocks of the first above-the-flood-plain terrace reach of 18 to 20 meters. The terrace deposits are coarse - fragmental psephitic (~ 40%) and sandy psammitic (~ 60%) rocks with horizontal and diagonal bedding. Boulders, shingles pebbles occur much more often among detrital rocks. Within the Teel and Khukh Ereg alluvial terraces we are have been able to find for the first time microdiamonds, corundum, cosmic spherules, rutile, olivine, diopside, garnet (pyrope), coesite, green and yellow spinel, khangaite (Fig. 5-tektite glass), etc. All the minerals were investigated by E.A. Gegallo on the scanning electron microscopy (CamScan-4) in Paleontological institute, RAS (Moscow) and T.Sersmaa in State University of Technology and Sciences (Ulaanbaatar). Cosmic spherules or meteoritic dust (Fig.2) are usually irregular in shape, fragmentation in flight, weathering, impact with the Earth's surface.

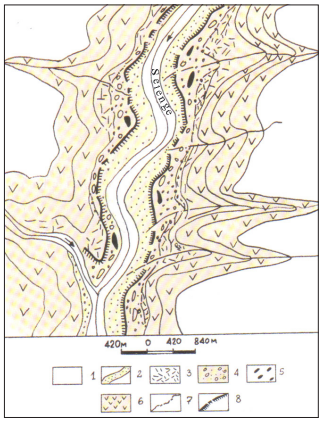


Figure 2: Map of the Middle Pleistocene alluvial terraces along the Selenge river basin (after Dorjnamjaa et al. 2008)

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

The surface smooth, furrowed or covered with shallow depressions. Black fusion crust is very thin (less than a millimeter), and is usually confined to one surface (size of 0,1 to 0,6 mm). Most irons have a brownish color due to oxidation of the iron during weathering. The irons consist mainly of nickel - iron alloys [2,4]. Many irons when cut and etched with acid reveal a complex intergrowth of kamacite and taenite known as Widmanstatten structure.

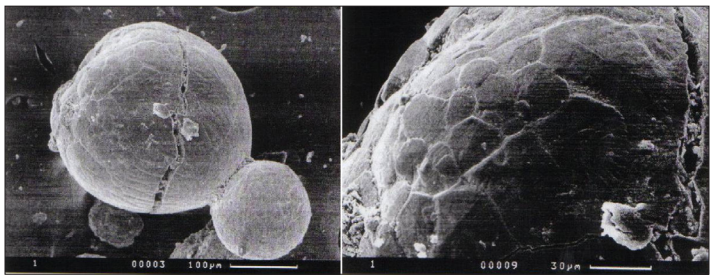


Figure 3: Cosmic spherules showing chondrules structure. The size of grain is 0,14-0,32 mm

Diamond microcrystals (0.2 mm in size) were extracted from several small panned samples (from 30 to 45 kg).It should be noted as well that the prevailing habit of diamond microcrystals is the cubic one (Fig.4), it has most developed surfaces from secondary forms and is holohedral. Facets of cube may have ideal subpsilate surface, as well as with rare or multiple tetragonal cavities. Contours of facets rounded, edges of facets sharp or rounded. The colour of diamond grains is mainly light-yellow, seldom gray, white, etc. [2].

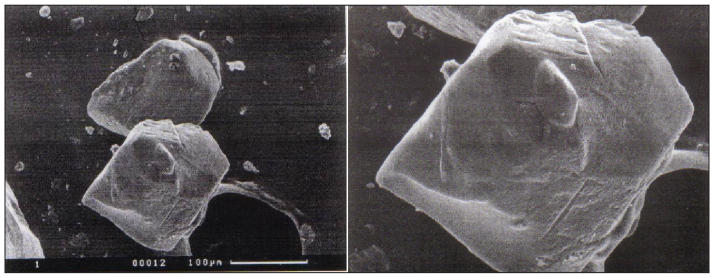
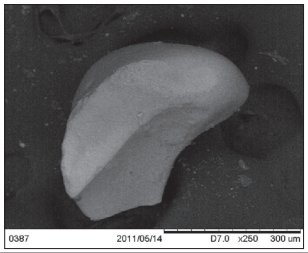
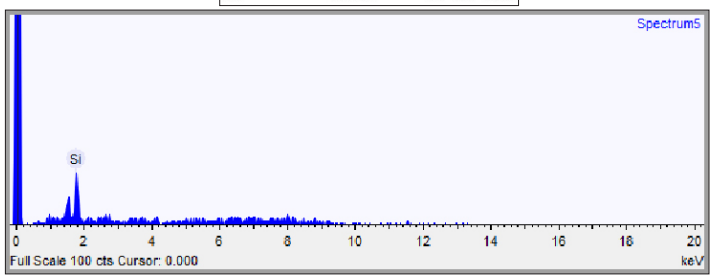


Figure 4: Irregular growths of diamond cubes, fragments (a) and a small magnification (b) of one in (a) from the Middle Pleistocene Teel placer, North Mongolia. Grain size is 0.18-0.2 mm.





Quantification method. All elements (normalised)

Summary results

Element	Weight %
Silicon	100.0

Figure 5. Tektite glass from the Selenge river alluvial terraces

Conclusion

Summing up all that has been said placer diamonds may have accumulated and concentrated in the alluvial above-the-flood plain terraces which are widely spread along the Selenge river basin.

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