GEOCHEMISTRY OF SNEZHNAYA CAVE SYSTEM (WESTSERN CAUCASUS, BZYBSKY RIDGE)

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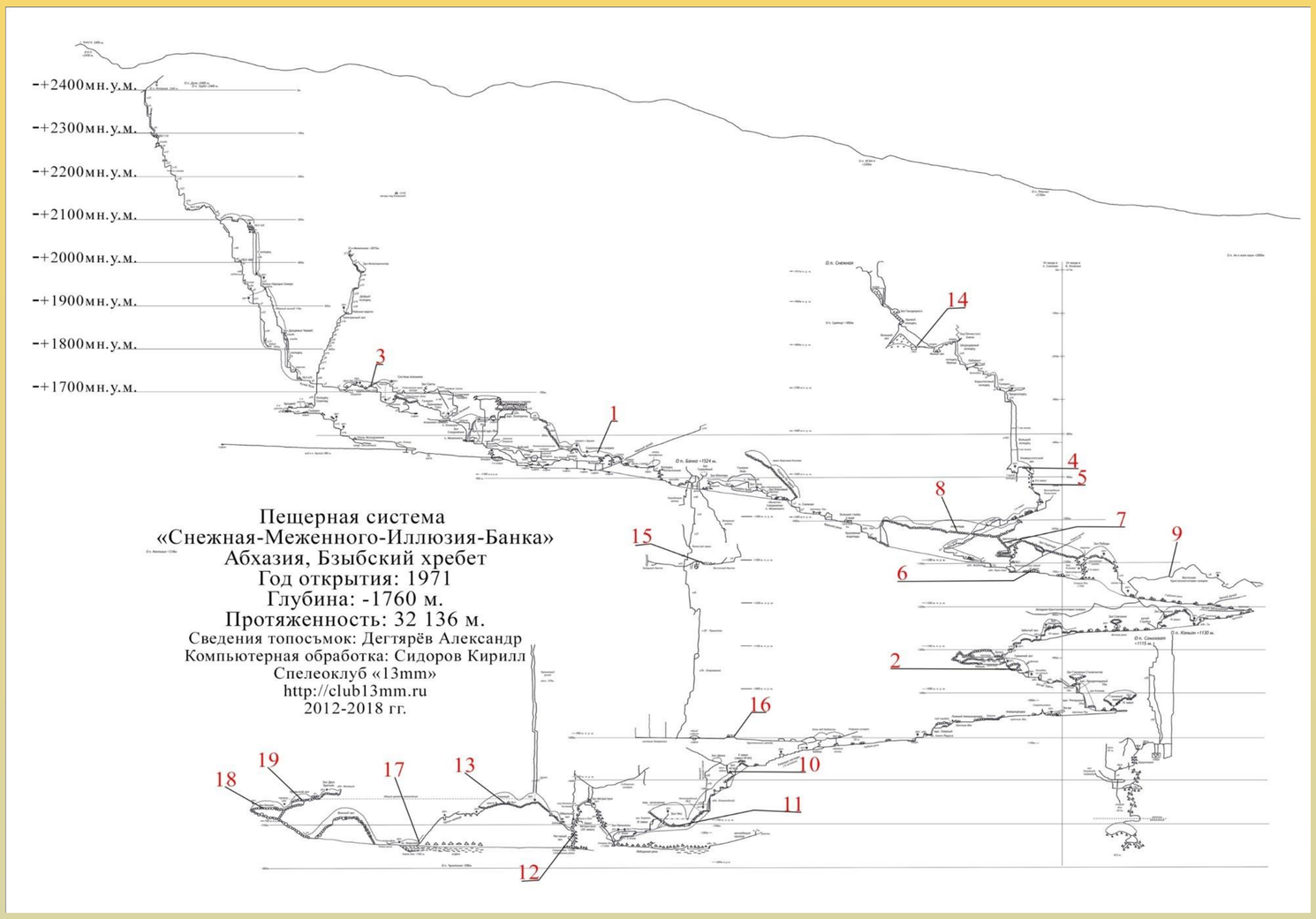


1 - Cave S. Mezhennogo, Sakhalin Gallery, samples of 2010.
2 - Cave Snezhnaya, Rattling Hall, samples of 2010 and 2014.
3 - Cave llusion, the area of the Shadow of Dreams gallery (-700 m), samples of 2010.
4 - Cave Snezhnaya, University Hall, samples of 2014.
5 - Cave Snizhnaya, Zero Blockage, samples of 2014.
6 - Cave Snizhnaya, district of the 4th blockage, samples of 2014.
7 - Cave Snezhnaya, Flower Course, samples of 2014.
8 - Cave Snezhnaya, Enfilade, samples of 2014.
9 - Cave Snezhnaya, Eastern Crystallictite Gallery, samples of 2014.
10 - Cave Snezhnaya, EGAN Hall, samples of 2014.
11 - Cave Snezhnaya, Hall X, samples of 2014.
12 - Cave Snezhnaya, Blockage under the hall of Metrostroy, samples of 2014.
13 - Cave Snezhnaya, Throne Hall, samples of 2014 and 2016.
14 - Cave Snezhnaya, Great Hall, foot of the snow-ice cone, samples of 2014.
15 - Cave Bank, Eastern Bow Gallery (-200 m), samples of 2016.
16 - Cave Bank, Crystal Meander (-500 m), sample of 2016.
17 - Cave Snezhnaya, Lake named after Morozov, samples of 2016.
18 - Cave Snezhnaya, Kosmos Hll, samples of 2016.
19 - Cave Snezhnaya, Uralsky Hall, samples of 2016.

The Snezhnaya spelean system is situated on the southern slope of a spur of the Bzyba mountain range in the Khipstinskiy karst massif in the west of the Greater Caucasus. The Snezhnaya cave was discovered in 1971. The spelean system's respective amplitude and length are 1760 and 40840 m. There are six currently known entries to the Cave: Illyuziya (entry at 2389 m.a.s.l.), named after S. Mezhennyj (2015 m.a.s.l), Snezhnaya (1920 m.a.s.l), Banka (1505 m.a.s.l), Fantasy (1318 m.a.s.l), and Khrenova Yama (1329 m.a.s.l).

The upper part of the system up to the depth of 450-600 m is embedded in massive and thick-layerd limestones and barrem dolomites, and the lower part is in alluvial breccias of the Lower Neocomian. The most common secondary minerals of the are calcite and Mg-containing calcite, aragonite, gypsum and hydromagnesite. Celestine and strontianite were also found at one of the sites. Dolomite, barite, apatite, goethite, pseudorutyl, as well as quartz, clay minerals, biotite, plagioclases, xenotime, zircon, and monazite were found as inclusions in the samples of the sedimentary crust, which, apparently, are impurities captured by the calcite crust during growth.

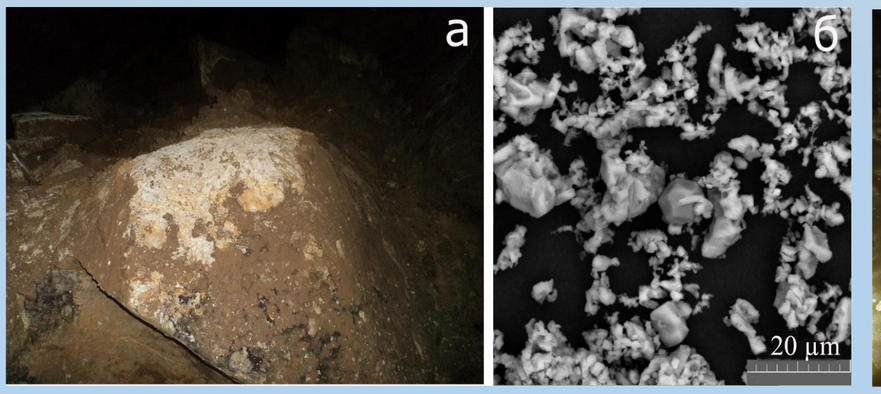
For the classification of water chemogenic formations, a classification based on the method of feeding the active solution was used, which operates with such group concepts as crusts. According to it, the analyzed formations belong to the classes of gravitational (stalactites, stalagmites), corallite (corallites, sedimentary crusts) and antolite crusts. Antholite bark is represented by gypsum ("gypsum flowers"). In addition, loose hydromagnesite formations forming precipitates on calcite-aragonite aggregates, as well as sand-clay water-mechanical deposits were analyzed.

When comparing the composition of secondary formations with the composition of the host rocks, it was found that during the formation of aggregates of gravitational crusts, CaO, CO_2, and to a small extent Sr accumulate. The remaining petrogenic components (SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MnO, MgO, Na_2O, K_2O, P_2O_5), as well as Pb and to a lesser extent Ni, V, Cu, and Sn are removed. At the same time, Co, Sc, Cr, and Ba remain inert. The formation of corallite crusts accumulates the same petrogenic components as in gravity crusts, as well as Ba, Sr, and to a lesser extent Cr, Mo, and Sn.

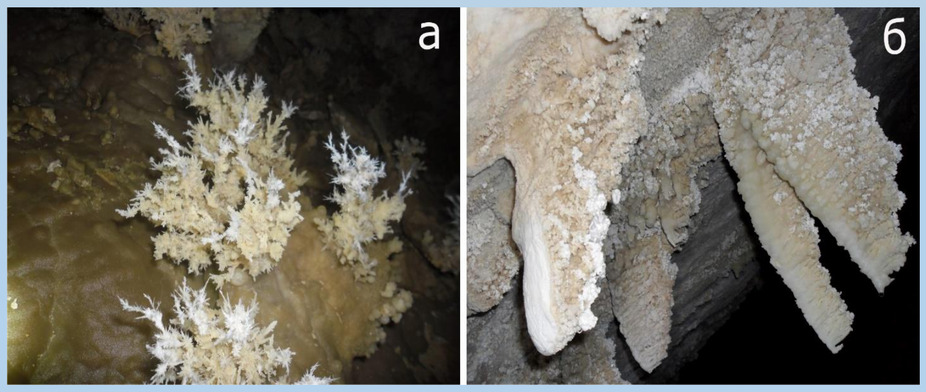
In loose sand-clay deposits, all petrogenic components accumulate, except for CaO, MgO, and CO_2, which are removed. From among the rare elements, Co, Ni, Sc, V, Cr, Cu, and Mo accumulate, to a lesser extent – Sn, Ba, and Sr, and Pb is removed.

Only the behavior of rare elements was studied for antholite crusts and hydromagnesite. In the antolite mountains, Sr, Co, and to a lesser extent Mo were accumulated and Zi, Ty, and Gbs were removed, while the content of M, Sc, Sc, Sn, and Bam remained at the level of the host rocks. During the formation of hydromagnesite deposits, only Sr accumulates, Pb and to a lesser extent Ni and Cu are removed, while Co, Sc, V, Cr, Mo, Sn and Ba remain inert.

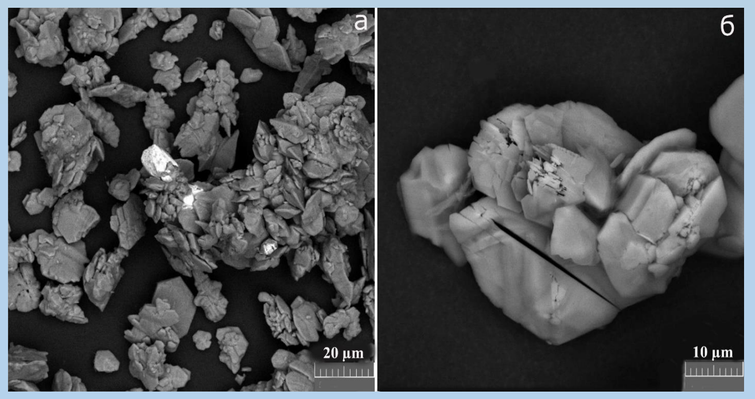
The aggregates of gravitational crusts formed in the flooded parts of the cave with the active influx of the feed solution are considered to be the most chemically pure. In the calcite of corallite crusts, which were formed with a less active supply of solution and the movement of water in thin films under the action of capillary forces, a large amount of impurities is observed, which are probably caused by an admixture of clay captured by mineral aggregates during growth. The sand-clay deposits accumulate almost the entire spectrum of rare elements, with the exception of Mo, Sn, and Pb, and all petrogenic components, except CaO, MgO, and CO_2, which are removed by dissolving the calcite and dolomite components of the host rocks.



Mondmilch (Bank branch, Bantik gallery). a - general view of the accumulation, partially overlapped by clay deposits; б - photograph under an electron microscope. Separate grains of quartz are visible among the calcite particles.

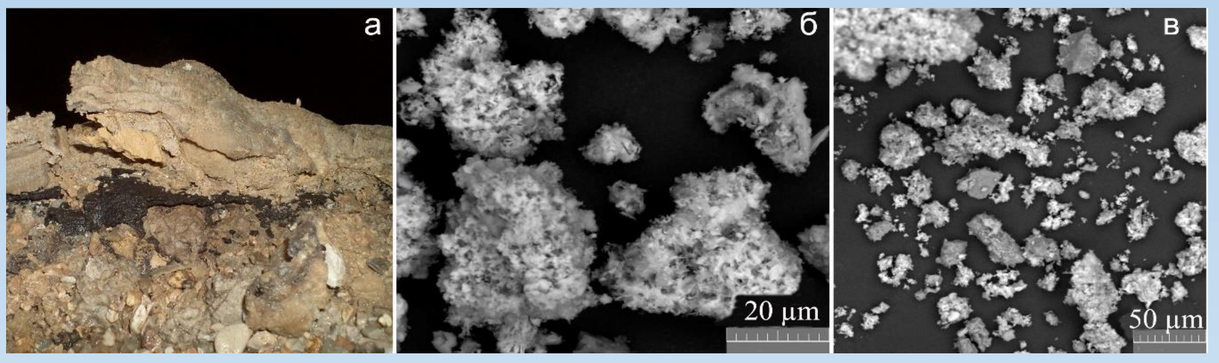


Snezhnaya, Flower Passage. a - deposits of hydromagnesite on the branches of aragonite crystallictites (Snezhnaya branch, Kristalliktitovaya gallery); б - hydromagnesite over calcite-aragonite crystallictites.



а, б - cave powder from the Illusion branch. Among the gypsum grains, one can see a grain of celestine (a); in the center of a gypsum grain, light stripes with small holes are visible, composed of Sr-containing calcite (б).

а - gypsum antolites in the Illusion branch (Diamond Gallery), б - gypsum antolites in the Snezhnaya branch, в - general view of the accumulation of gypsum cave powder on the floor of the passage (Illusion branch).



Manganese minerals. a - general view of the layer on top of clastic deposits (Bank branch), б, в - view of mineral particles of the sample under an electron microscope.