MINERAL AGGREGATES IN THE *PROMETHEUS* CAVE IN WESTERN GEORGIA

Elena N. Matvienko
Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, mineral@fmm.ru

In 2011 near Kutaisi in the vicinity of Tsqaltubo city within the Lower Cretaceous limestones the Prometheus cave has been opened for visitors. The main types of mineral aggregates developed within the cave have been described.
7 photos, 6 references.
Keywords: karst of Western Georgia, Tsqaltubo Plain, the Prometheus cave, mineral aggregates developed within the cave.

In September 2012 the author was happy to visit Georgia during the two-week tour with karst cave-bearing territories attending.

Due to the very often development of limestone strata belonging to the Cretaceous and Upper Jurassic periods at the Caucasus (and especially thick at the Southern slope of the Great Caucasus ridge), karst in Georgia is excellently revealed. In several regions of Georgia the total thickness of karst-able rocks varies 1200–2600 m (Geology of the USSR, 1964). This fact as well as several other favourable regional factors: hot and wet climate with abundant sediments, and active tectonic processes cause vast and various karst occurrence. Before 1990es more than 600 caves have been registered on the Georgian territory – more than two third the all known caves on the territory of the Former Soviet Union (Tintilozov, 1976). Most of caves are situated at the Western Georgia. Large Georgian limestone strip located in the intermediate place between the folded system of the Southern slope and the Georgian Block is attributed to as a large speleological province (Geology of the USSR, 1964). Novoafonskaya among the well-known caves of the Abkhazia one is the most famous was discovered in 1961 and opened for visitors only in 1975. Within the scheme of speleological regioning this cave has been attributed to the subprovince of fore-mountainous and low massifs as well as the caves of the Lower-Imeretinsky region. These caves are situated now at the territory of the modern Georgia (and the Tsqaltubo wavy plain, in particular) and similar in several features with them (Tintilozov, 1976). The lowland consists predominantly of the Lower Cretaceous limestones.

Tsqaltubo karst region is situated at the eastern wavy and hilly vicinity of the Kolkhidskaya lowland, in the valley of the Tsqaltubo River, to that from the north-east branches of the Sal`gural`sky ridge of the Great Caucasus are attached. Tsqaltubo balneological Spa Resort located 9 km to the north-west from the Kutaisi city is known due to its thermal waters and radon-bearing springs. Before the 1990es Sataplya State Reserved Park existed here. It was found in 1935 and was famous with dinosaurs traces and a small and attractive Sataplya Cave (modest in compare with the Novoafonskaya Cave).

In 1973 a new cave was discovered by the researchers of the karstological and speleological laboratory of the Vashukhti Geographical Institute, Academy of Sciences of Georgia, in 9 km to the north-west from the Tsqaltubo in the vicinity of the Kumistavi village. During further investigation beside this cave the large system of caves jointed together by an underground river was discovered. In newest times the territory received a grandiose governmental support of tourism development in Western Georgia, and the Sataplya and Kumistavi caves have been well-developed for tourist visits. In 2011 the cave was opened for visitors under the name *"The Prometheus cave"*.

The entrance to the Prometheus cave is located 100 meters above sea level. Its square is estimated as 200–250 sq kilometers, and its depth from the earth`s surface – 40 meters. As it was shown during investigations, its full length of all coridors is about 20 kilometers. Now it is known that the cave consists of 17 halls, and 7 entrances-subcaves. Nowadays there is tourist route with a length of 1.6 km that is finished near the underground lake where all visitors take a boat and sail out by the underground river to the earth`s surface. Constant temperature in cave is +14°C. Bats live here as well as creations adapted to live in darkness: freshwater mollusks, spiders, worms, crustaceans. Paths and stairs are arranged in such a way that tourists can visit five large cave halls (up to 35 m length and 7 m in height) (Fig. 1). Artificial lighting sometimes are coloured, together with soft romantic music evoke an atmosphere of mystery.

Fig. 1. Sight from the viewing platform. Fence 1 meter high. Photo: A. Lobachiov.

Fig. 2. Stalactitic-stalagmitic crust. Height of the «pagoda» at the right – 3 m. Photo: A. Lobachiov.

Fig. 3. Stone «waterfall», 3 m high. Photo: A. Lobachiov.

Fig. 4. Stalactitic-stalagmitic crust coloured by terrigenic admixture. Height of the ceiling up to 2.5 m. Photo: A. Lobachiov.

First of all, one may note the complicated form of the karst cavity, feature of multiple (not once) rock falls, distinct manifestation of stadiality of cave forms genesis when periods of mineral formation alternated with stoppings-interruptions, and apparently with periods of dissolution. As a whole, these features as well as giant stalactite-stalagmitic formations (Fig. 2) are similar to the Novoafonskaya cave.

Viktor I. Stepanov has investigated the Novoafonskaya cave and described characteristics of genetic stages of its development (Stepanov, 1971). It was interesting for us to compare our cave observations with Stepanov notes and describe *Prometheus* mineral aggregates based on the terms suggested by him and used during his work on "*Caves*" exposition in the Fersman Mineralogical museum based on the material from Central Asia caves.

As in the Novoafonskaya cave, very thick tuff stalactite-stalagmitic crust is developed within the Prometheus cave. In this case we mean the calc-tuff — pore calcitic rock forming the most thick gravity cave formations (Stepanov, 1971; 1998). At the steep places of blocks obstructions tuff crust makes huge «waterfalls» formations (Fig. 3).

The reason of colouring of stalactite-stalagmitic crust is terrigenic admixture (clayish, clay-sand-bearing). And very often this admixture is not distributed evenly, and we can see fragments of pure-white translucent forms (Fig. 4) of more late generations in origin.

Thus, in places one can observe calcitic stalactite-stalagmitic crust crystallization which occurred more slowly than that of a tuff crust, and it was going without capture of terrigenic material admixture belonging to streams periodically fulfilling the cave. In places occurs uneven colouring of cave forms by ferruginous compounds in reddish-brown tones (Fig. 3), and locally — in yellow and merely bright (result of bacterial activity?) as well as in black colour with metallic luster apparently due to the admixture of manganese compounds (vad $MnO_2 \bullet nH_2O$?).

Stalactites (Fig. 5) here are very abundant, and more often than in the Novoafonskaya cave. There are many different forms: conical, cylindrical, and flattened. During cave development some stalactites were cut and in the centers of stalactites cross-sections we can see feeding channels with continuing process of stalactite formation droplets of sucking fluid (if there is a favourable lighting); as it may be often seen at the edge of stalactite cross-section, it becomes the place of overgrowing by new generations of small stalactites (Fig. 6).

Linear ensembles of stalactites are very common if they are developed along cracks of the vault (Fig. 5, 6), as well as flattened stalactites — products of linear sucking (Stepanov, 1998). Such natural mineralogical plumbs accurately following change of the location in space of the feeding surface, became more complicated in their forms, and sometimes coalescence in place forming fanciful bending drapes (Fig. 7). One should note almost transparent strips that can be distinctly seen at the background of coloured by the terrigenic clayish (Fig. 7b).

We can name these formations crystalactitic similarly to translucent drapes at the "Caves" exposition the translucent drapes at the exposi-

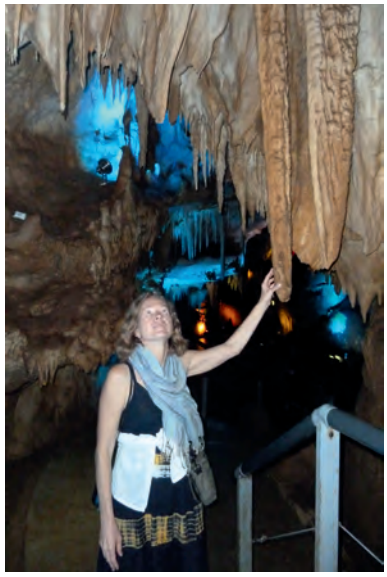


Fig. 5. Stalactites. Photo: E. Kislova.

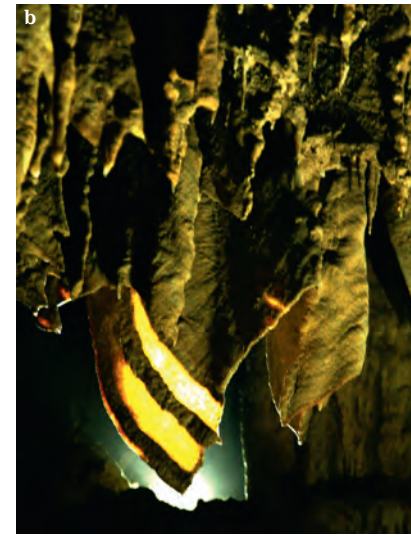
Fig. 6. Stalactites and stalagmites of the same generation. Photo: T. Pavlova.

tion "Caves" due to their coarse-grained texture (Stepanov, 1998).

Stalagmites are also very variable. Vastly abundant are tuff stalagmitic crusts that arise during the surface feeding (flat gravity stream) (Stepanov, 1998). Typical crusts named "fried eggs" (Fig. 3, at the front plan) forming at the earliest stage of growth of the stalagmite itself during its axial feeding, before the moment when geometric selection acts during the former growth. Large tuffo-calcitic stalagmites (in other words, tufflagmites, according to Stepanov, 1998) are very outstanding cave formations. They are similar to those developed in the Novoafonskaya cave, with complicated surface relief that reflects multistadiality of their origin (Fig. 2). Conical and cylindrical stalagmites in places overgrowth stalagmitic crust surface — incrustations (Figs. 4, 6) often coloured due to the admixture of clay minerals. One may observe white-snowy form with sparkling surface of numerous crystal faces.

Corallitic crust formed due to the evaporation of capillary thin films during «dry» periods is well developed in the Novoafonskaya caves (Stepanov, 1971) in side burrows, and secluded

Fig. 7a, b. Stalactitic drapes: a — dimension up to 0.8 m. Red lighting. Photo: A. Lobachiov. b — Strips without terrigenic admixture, up to 4 cm wide. Photo: T. Pavlova.



corners. In the Prometheus cave, when we walked along the main route, we have seen the overgrowth of corallites onto earlier crystallization forms; these forms may be named corlactites and ensembles of corallites and stalactites similar to those known in the Khaidarkan caves and shown at the exposition in the Fersman Mineralogical museum as well as corallites and stalagmites.

Such gradual forms as transition of conical stalactites into corallites are very common. It is very typical process as a steep transition from the gravity structures to the corallitic ones parallel with diminishing of film thickness and thus its ability to move under the gravity force (Stepanov, 1998).

Helictites are fantastic twisting cylindrical branchlets (direction of growth of which are not influenced by the gravity force) arising during the crystallization on the exit from the capillary channel. We failed to detect these cave formations for sure, where as in the Novoafonskaya cave within the Helictitic hall they overgrowth onto stalactites. In order to determine properly the cave forms, one ought to investigate the character of feeding channel; in different case we may miss these forms with eccentric stalactites.

As a rule, in the *Prometheus* cave definite forms are often hardly properly characterized due to their complicated genesis, and vast distribution of such parageneticаl ensembles as stalactite — drape as well as hybrid structures (Stepanov, 1998). In many cases parageneticаl ensembles reveal individuality of their morphology that forces us to remember that they have been descripted in terms of "behaviour" analogous to the characteristics of live organisms (Slyotov, 1985).

Among the products of crystallization of one of the generations in the Novoafonskaya cave a lot of gypsum aggregates occurred (Stepanov, 1971), and it is very probable to find this mineral within the *Prometheus* cave formed during the «dry» period of its life (Maltsev, 1993).

Author expresses her true gratefulness to N.A. Vaganova, A.M. Makarova and T.G. Pavlova, the leaders of the tour, as well as to our friends who gave us permission to use their photos in this publication.

References

Geology of the USSR. Vol X. Chapter. 1. Moscow: Nedra. **1964**. 656 p. (in Russian).

Maltsev V.A. Minerals of the Cupp Coutunn karst cave system, Southeast Turkmenistan // World of Stone. **1993**. No 2. P. 5—30.

Slyotov V.A. On the onthogeny of crystallictitic and helictitic calcite and aragonite aggregates from the caves of the Southern Fergana // New Data on Minerals. **1985**. Vol. 32. P. 119—127 (in Russian).

Stepanov V.I. Periodicity of crystallization processes within the karst caves // Trudy of the Fersman Mineralogical Museum. **1971**. Vol. 20. P. 161—171 (in Russian).

Stepanov V.I. Textures and structures of mineral aggregates originated in the free space of cavities // Speleology in the Russia. **1998**. Issue. 1. P. 70—91 (in Russian).

Tintilozov Z.K. Karst caves of the Georgia. Tbilisi: Metsniereba. **1976**. 275 p. (in Russian).