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Concretion Onyx of the Torgashino Deposit – New Type of Carbonate Vein Onyx (Krasnoyarsk Territory)

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A new type of carbonate vein onyx is identified. The onyx composition is calcite. Banding is preconditioned by alternation of the zones of light calcite, and calcite rich in ferruginized argillisite. Three types of vein bodies are composed of poorly dislocated, brecciated and concretion onyx. The latter type is presented by easily dissected concretions (5-12 cm). Calcite crystal fragments (1-3 cm) overgrown by concentric-zonal ferruginized much argillisite-altered calcite onyx looking like "rounded pebble" (2-4 cm) from outside, overgrown in its turn by concentrically banded large radial-columnar calcite crystals form the concretions. Concretions are interesting in terms of collection material.

Keywords: Krasnoyarsk Territory, Torgashino deposit, vein onyx, concretions.

Carbonate onyx is a banded calcite or aragonite aggregate. The name of the stone is ancient Greek ("onyx" – nail). Its pinkish and yellowish tints reminded of nails to the Greeks. Nowadays onyx is generally interpreted as different banded stones – chalcedonic (agate), fluorite, carbonate ("marble", cave) and others. We are of the opinion that the name of banded carbonate rocks – "marble onyx" – widely used in literature and agreeing well with the early propositions of other researchers [1] is not correct. This rock, neither by genesis nor structural or textural peculiarities, or sometimes composition (aragonite onyx), has nothing in general with marble. Carbonate onyx is the most acceptable name for this rock.

Carbonate onyx can have calcite, calcite-aragonite or aragonite composition. It is found in two morphologically and genetically different types of bodies. One of them represents vein (stratal) type and is a result of fracture system filling. The other one is a dripstone type in the form of crusts, covers, stalactites, stalagmites and other similar formations in karst cavities. The following is taken into account for onyx classification in addition to formation conditions and the mineral composition: dominating colour – white, green, yellow, pinkish-yellow, pink, light-brown, brown, dark-brown;

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transparency – semi-transparent, translucent, non-transparent; banding morphological peculiarities – straight-line, undulating, concentric, banded-spotty; carbonate and clay-carbonate aggregate texture – cryptocrystalline, fine-grained, transversal-fibrous, columnar, plicate, pelitomorphic, breccia; structural aggregate peculiarities – banded, concretion, compact, porous etc.

The Torgashino limestone deposit is one of the places of vein carbonate onyx location [2]. This deposit is located at the northern end of the Mana downfold in the northwestern part of the Eastern Sayans, in the field of development of the Torgashino and the Shakhmatovo Lower Cambrian suites composing a single carbonate stratum. The total area of its development at the Yenisey and the Bazaikha Rivers watershed is about 50 sq.km. The carbonate stratum is mainly composed of limestone with dolomite limestone and dolomite lenses and interlayers, with single brecciated limestone, siltstone and sandstone interlayers. Gray and light-gray colours are typical for carbonate rocks. They are massive, fine- and small-grained. Stratification is rare. Karst surface and underground cavities containing cave dripstones and sometimes filled with loose clastic material are widely developed within the carbonate stratum.

The Torgashino carbonate onyx deposit is territorially located at the southern outskirts of the City of Krasnoyarsk, at the northern slope of the Torgashino Ridge, in limestone production pits of the Krasnoyarsk cement plant and other enterprises of the city. The discovered bodies are located within the currently closed Uval Promarteli, Tsvetushchiy Log pits and the currently operating Cherny Mys pit. Carbonate onyx bodies were found at the area of 3.3x2.5 km. They have an irregular shape; their genesis is preconditioned by filling of fracture structures with banded carbonate aggregates, frequently bearing indicators of tectonic activation and imposed argillisite alteration processes. Two largest vein bodies are 10x10x7m and 10x5x5m in size. The sizes of other known vein-shaped carbonate onyx bodies across do not exceed two meters. The total volume of bodies, together with minor veins, is estimated equal to 1.1 th.cub.m.

Carbonate onyx has monomineral calcite composition. No aragonite or dolomite is detected in this rock. Banding is associated with clean yellowish, yellowish-green calcite interlayers alternating with calcite coloured by an admixture of pelitomorphic material – the argillisite-alteration product brownish-red in colour preconditioned by elevated ferric hydroxide content.

The analysis of the Torgashino deposit onyxes different in ornamental properties allows to identify four structural types amidst them: straight-banded, undulating-banded, concentric-zonal and banded-spotty. Onyxes of the first three types are characterized by mainly clear pattern and a different width of bands. Thin-banded varieties with the width of coloured bands from millimeter fractions to 1.5 mm, banded varieties with the band width up to 5-10 mm and wide-banded varieties with the bands 15 to 50 mm wide are identified. Thinner rhythmicity can be visually seen in the latter two varieties. Different-banded types characterized frequently by regular replacement of banding types from vein contacts to the center are generally observed. The bands 1-12 mm wide in banded-spotty onyxes have bulges and crimps, amidst which white, light-yellow spots of irregular shape, about 15x25mm in size are present. The pattern of rocks depends on, but is not limited to, the section orientation. In longitudinal sections of undulating-banded onyxes it becomes spotty or concentric-zonal. The texture of light-coloured bands is small and fine-grained, plicate and plicate-columnar; and of dark-coloured ones – cryptocrystalline. In some cases wide bands are composed of drusy pinky-white calcite.

Stone ornamentality is enforced by different colours of banded and spotty aggregates. The red-brown colour dominates in some varieties, and the yellow colour dominates in the other ones. Reddish-brown onyxes have multiple tints – from cherry-red to orange and pink. The yellow colour is mainly presented by light-yellow and greenish-yellow tints, rarely honey ones. With banding type replacement the intensity of colour changes as well – from thickly coloured to light, almost white.

Fracturing in carbonate onyx bodies allows to produce defectless blocks 10x10x10 cm in size and above. In some cases blocks up to 10x50x50 cm in size can be produced. All carbonate onyx varieties are easily polished, close to mirror, and shine through in plates up to 1 cm thick. The stone preserves integrity when cut into plates up to 5 mm thick and further treated.

The analysis of various forms of fracture structure filling with carbonate material shows that three types of onyx veins can be identified:

1. veins composed of poorly dislocated onyx,
2. brecciated onyx veins, and
3. veins filled with concretion onyx.

Banded varieties with different patterns (straight-banded, undulating-banded, etc.) were formed in the first vein type filled with poorly dislocated onyx. The mineral formation process occurred continuously in fractures which extended in the process of tectonic movements at the catagenesis stage. Banded onyx veins were hardly influenced by disjunctive dislocations, which a clear undisturbed onyx pattern testifies to. Multiple aggregate generations are distinguished on the basis of colour boundaries and colour replacement of these generations as well as crystal sizes. The bands were painted in dark-brown to yellowish-white colours due to increased content of ferruginized argillisite. Late fracturing sometimes occurring in carbonate onyx bodies led to pattern and colour destruction. The fractures located almost perpendicular to the layers are usually filled with later calcite.

Brecciated onyx veins are the second vein type. They are filled, like the first type, with banded carbonate onyx. Their peculiar feature is clearly expressed disjunctive dislocations. Multiple fractures and crushed zones with later vein extension were cemented by later yellowish-white large-crystalline calcite. The onyx colour in such veins is usually dark-brown or reddish-brown, which is associated with presence of ferruginized argillisite. Accordingly, brown bands have thin-banded, cryptocrystalline and even pelitomorphic construction, and light pinkish-white and white bands have middle-banded construction.

The third type of veins is a unique formation. The study of similar deposits shows that a new aggregative type of fracture carbonate onyx – concretion – has been discovered (Fig. 1, 2). Concretions were formed in fracture cavities filled with clayey products (ferruginized argillisites), on the walls of which calcite crystal druses were located. These crystal fragments up to 10-15 mm in size served as concretion cores. Initially, they were overgrown by concentric zonal ferruginized, intensively argillisite-altered calcite onyx, so that these formations looked like rounded pebbles. The size of the latter usually varies from 1 to 3 cm. Afterwards, with fracture structures extension, “pseudopebble” was overgrown by large radial-columnar irregularly coloured (concentrically banded) calcite crystals (Fig. 3) [3].

Vein cavities are filled with concretions tightly neighbouring each other, usually 5-12 cm in diameter. In some cases they are easily dissected into individual aggregative formations when such veins are destructed.

Moreover, we found a single gigantic concretion, the diameter of which exceeded one meter (Figure 4). This concretion had a fragment of light-gray calcite limestone up to 20 cm across in the center. An aggregate of compact concentrically zonal light greenish-white calcite onyx up to 40 cm thick was formed around it. The concretion had a flattened round shape and, being about 50 cm thick, had a fracture face revealing its internal construction. The size of this concretion testifies to uniqueness of some of such formations at the Torgashino deposit. Moreover, the diagenetic process of concretion formation traditional in the genetic terms is supplemented by the variant of concretion onyxes in the Torgashino strata being the products of the low-temperature hydrothermal process corresponding to the catagenesis stage.

Carbonate onyx of the Torgashino deposit can be used for manufacture of high-class stone-cutting and mosaic products, and fine-patterned onyx can be selectively used as jewelry- ornamental raw material for inserts in fancy goods: rings, brooches, cuff links etc. The stone block nature allows to use it for facing of building interior elements. All carbonate onyx varieties, including concretion onyx of the Torgashino deposit, appeal as excellent collection material. This is what makes these formations unique.

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Конкреционные ониксы Торгашинского месторождения – новый тип карбонатного жильного оникса (Красноярский край)

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Выделен новый тип карбонатного жильного оникса. Состав оникса кальцитовый. Полосчатость обусловлена чередованием зон светлого кальцита и кальцита, обогащенного ожелезненным аргиллизитом. Три типа жильных тел сложены слабодислоцированным, бречированным и конкреционным ониксами. Последний тип выполнен легко расчленяющимися конкрециями (5-12 см). Внутри конкреций находятся обломки кристалла кальцита (1-3 см), которые обрастают концентрически-зональным ожелезненным сильно аргиллизированным кальцитовым ониксом, имеющим снаружи вид «окатанной гальки» (2-4 см), которая, в свою очередь, обрастает концентрически полосчатыми крупными радиально-шестоватыми кристаллами кальцита. Конкреции представляют интерес как коллекционный материал.

Ключевые слова: Красноярский край, Торгашинское месторождение, жильный оникс, конкреции.