PISOLITES AND PISOLITELIKE FORMATIONS

T. GÁNTI

(Institute for Mineralogy and Geology of the University of Technology, Budapest)

ABSTRACT

Genetically one can differentiate four groups of pisolites. In the first one the water covers uniformly the sand granules moving in the spring and thus peas form which later settle on the stone. In the second case well developed calcite crystals are covered subsequently by a microcrystalline calcite layer. This second case is characterised by a great radius curvature. The third case occurs in cold waters when previously separated lublinite puffs are covered by a thin steadily thickening calcite layer. To the fourth group the so-called rosestones belong. In their case an aragonite layer is deposited by the water and in the course of its slow transformation into the more stable calcite, which has a larger specific volumen, it becomes blistered. Many of such blistered layers deposited on one another create a pisoltelike formation which is called rosestone.

$CaCO_3$ separated from hot springs is mostly sedimented onto the wall of galleries as pisolitelike formations. *Cholnoky* called very appropriately these formations — to differentiate them from the pisolites — according

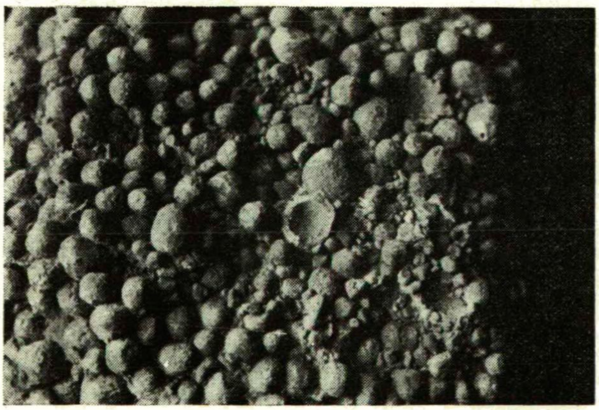

Fig. 1. Real peastone or pisolite from the plateau of Kiscell

to their shape *rosestone*. The latter had to be differentiated from the former as their genesis is not identical. In addition to the rosestone and pisolites other pisolitelike formations may be found along waterways, this holds not only good for the hot springs, but also in the case of cold waters of Karst. *Our investigations show that genetically four different groups of pisolite formations can be distinguished.*

1. The formations are only called *pisolites,* or *real peastones* if the shape of the stones is globular. They form through the crystal- or sand granule being — owing to constant movement of the water — uniformly globularly covered by the $CaCO_3$ deposited from the water. Such uniformly covered globes can be found, e. g. in the »bird nests« of the Vass Imre cave. If the conditions for their formation are suitable these pearls occur in springs too. [1] When the water output of the spring decreases, or if the pearls become so large that the water can no more move them, the globes settle down on the rocks and are stuck together by the $CaCO_3$.

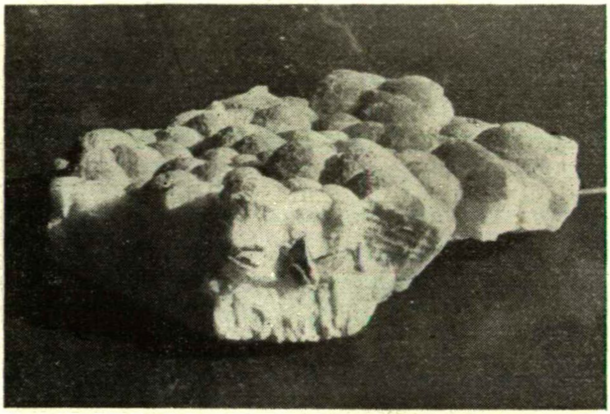

Fig. 2. Peastone formed through a microcrystalline calcite incrustation covering large calcite crystals after they developed. The place of one of the crystals is filled with plastiline

2. Sometimes the separated well developed calcite crystals are subsequently covered with a microcrystalline calcite layer. These formations strongly resemble peastones. A characteristic feature of all these formations is that when they are older their radius of curvature may amount to some decimetres. Such a peastone is shown on Fig. 2. For the sake of demonstration the place of one of the calcite crystals was filled with plastiline.

3. *Lublinitic peastone.* In the Béke cave *L. Jakucs* [2] observed a quite specific pea formation which forms in cold water. According to him, first of all lublinite puffs separate themselves on the wall of the cave which are subsequently covered with a steadily thickening calcite layer.

4. *Rosestones.* Their formation cannot be attributed to any of the enumerated mechanism. It is true that the first part of their formation frequently corresponds, or resembles that of those mentioned in 2.), however, the values of their radii of curvature are never so hight, and their structures also differ considerably. The formation of such peastones is

due to crystallographic reasons. The specific volumen of calcite is larger than of aragonite. The latter having a specific gravity of 2.94 separated from water the temperature of which exceeds 30°C and transforms slowly into calcite. The specific gravity of the latter is 2,71, thus the transformation is associated with an increase of the volume, as a result of which the layers blister. On the blistered layers aragonite deposits which after a time again transforms into calcite. Obviously at the place where there was already a curvature the fold will be large. Hence the blistered layers exhibit the structure shown on the Fig. 3.

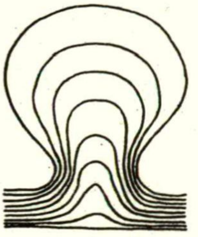

Fig. 3. Formation of rosestone through blister formation in the layers

Such a structure can be seen in a section on Fig. 4. too. Owing to its lamellar structure if the top of the stone wears off it resembles a rose. If the sedimentation is slow and the transformation of aragonite into calcite also proceeds steadily and slowly the separation in layers may not occur and the deformation only takes place in the habit of the microcrystals. Of course, the folded structure remains.

Fig. 4. The formation of the rosestone may be due to the fold in the layer caused by the transformation of aragonite into calcite. Such a fold is illustrated on the Fig. about three times magnification.

If there is a possibility for aragonite separating in cold water caves rosestones may also form. Since according to Ostwald's rule always the less stable modification is to be separated first out of a solution and only is transformed after a certain time into the more stable one, it is also possible for aragonite to be separated in cold water.

This assumption is also supported by Murray's investigations which proved that under cave conditions aragonite may be separated also at low temperatures in quantities the percentage of which can be well determined particularly if ions in solution are present too. In the waters of the Karst primarily Mg plays a role which can be found in large amounts in the Karst waters, furthermore also Sr, although the latter

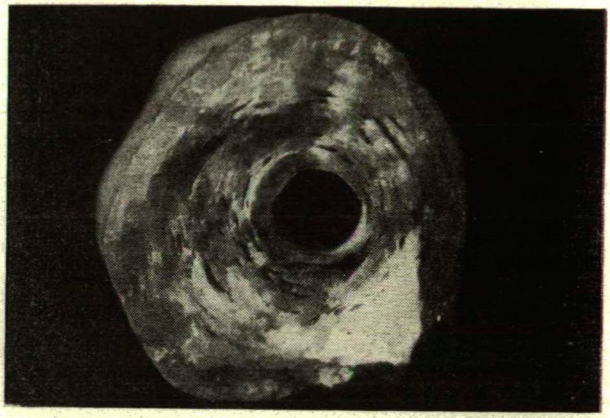

Fig. 5. Dripstone from cave Vass I. Cross section. The ring separation due to the transformation of aragonite into calcite is well visible. About three times magnification

is only present in small quantities, promotes considerably the formation of aragonite. The rate of its transformation into calcite depends upon the temperature, the pressure, the impurities and the liquid with which it is in contact. The pressure is a factor which cannot be neglected as in the interior of a formation — just owing to the crystallization — an appreciable pressure may prevail. On dripstones a lamellar separation due to the transformation of aragonite into calcite may also occur.

REFERENCES

1. Kunsky: Reise in die Unterwelt.
2. Jakucs L.: A Békebarlang felfedezése. Budapest, 1953.
3. Murray: The deposition of calcite and aragonite in caves. J. Geol. 62. (1954) p. 481.