A New Melanophlogite Occurrence

from

The Case Montanini Quarry Parma, Northern Appennines, Italy.

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The sixth worldwide melanophlogite discovery took place in a quarry at Case Montanini, Northern Apennines, Italy. This uncommon mineral occurs in crystals associated with opal and quartz.

INTRODUCTION

A new occurrence of melanophlogite has been found in a quarry located in the Northern Apennines, Parma, Emilia Romagna, Italy. A search of the literature indicates that it is the sixth known occurrence worldwide. This report on the find is derived in part from Adorni *et al.* (2004).

The Parmesan district is among the westernmost areas of the Emilia Romagna region and in its southern area is crossed by the North Apennines Mountains. The melanophlogite locality can be reached from Parma, following the Taro River Valley, to *Fornovo Val di Taro*. After reaching a place called *Felegara,* proceed onward to *Visiano*, a village adjacent to two quarries, the Case Montanini and Faieto quarries. Both produce additives for the cement industry. The former is still in operation, whereas the second has been closed and is undergoing environmental reclamation.

HISTORICAL BACKGROUND

Sicilian melanophlogite found in Racalmuto and Lercara was described for the first time by Von Lasaulx (1876). Skinner and Appleman (1963), during studies on specimens from U.S. National Museum of Natural History (originally from Waldemar T. Schaller), confirmed that melanophlogite crystallizes in the cubic system, and described its crystal habit, its paragenesis with sulfur, celestine, calcite and opal, and noticed that it could be often found as quartz pseudomorphs after melanophlogite.

The second find was reported from Chvaletice, Bohemia (Zak, 1967; Zak, 1972), in a methamorphosed pyrite and rhodochrosite sedimentary deposit. In 1972 two additional localities were reported, the first at

Fortullino, Livorno, Tuscany, Italy (Grassellini and Orlandi, 1972), in a serpentinite breccia at the contact with magnesite lodes, and the second at Mount Hamilton, Santa Clara, California (Cooper and Dunning, 1972), always in serpentinite but included in sandstones and Jurassic clayey schists.

The fifth find was reported from Tsekur-Koyash, Crimea, Ukraine, (Kopatsheva and Makarov, 1975), also in a sulfur deposit. There is also the discovery of a melanophlogite-containing pebble in the Pacific Ocean offshore from the Oregon Coast (Kohler *et al.*, 1999). The specimrn was dredged from a depth of 700 meters by the research boat *Sonne*, near ODP (Ocean Drilling Project) Point 892 (S. Kohler, personal communication), in a area where vents were expelling fluids rich in methane.

Zak (1972) and Gies *et al.* (1981) believe melanophlogite to be tetragonal at room temperature; Gries (1983) concludes that the transition point is between 55°C and 65°C, whereas Nakagawa *et al.* (2001) prefer to subdivide the nomenclature into low-temperature (α-melanophlogite) and high-temperature (β-melanophlogite) phases.

GEOLOGY

At the Case Montanini quarry, as at the Faieto quarry, there are outcrops of the stratigraphic unit known as the "Tripoli di Contignaco"; this unit is composed of marine sediments consisting of whitish and siliceous gray-green marl with alternating layers of volcanoclastic sediments and rare diatomaceous material that has not been altered by diagenetic processes. Compositionally all of these layers are high in silica, derived primarily from the siliceous skeletons of micro-organisms (diatoms and radiolaria).

The siliceous relics were originally composed of amorphous opal-A, which has been transformed into the less soluble structural state called opal-CT, during the burial (Williams *et al.*, 1985). Opal-CT is also potentially unstable and tends to convert to quartz, but in the quarry area the conversion did not take place (Tateo, 1992), indicating that the temperature, depth and duration of burial of the sediments were insufficient to cause the change. According to the model proposed by Tada (1991), the conversion from opal-A to opal-CT takes place at about 60°C for Lower Miocene sediments under a medium geothermal gradient (about 30°C /km). Sediments containing unaltered opal-A found 3 km northwest of the Case Montanini quarry suggest even lower temperatures there (Tateo, 1992).

MINERALOGY

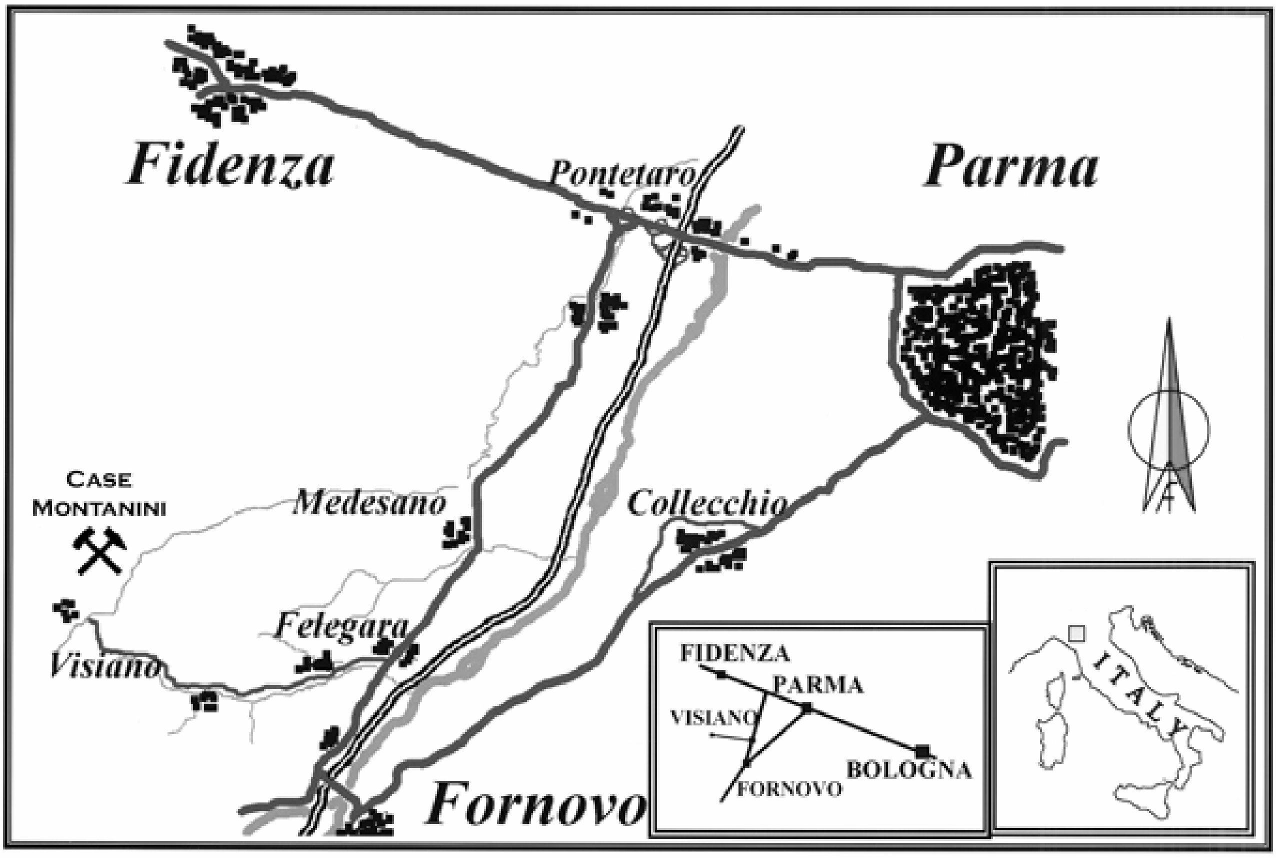
Melanophlogite was identified by X-Ray powder diffraction using a Siemens D-5000 diffractometer, equipped with Cu tube, secondary monochromator and sample spinner. The analysis was conducted by one of the authors (F.T.) at the C.N.R.'s Institute of Clay Research in Tito Scalo, Potenza, Italy.

In the Case Montanini quarry, melanophlogite is common, whereas in the nearby abandoned Faieto quarry it is rare. The melanophlogite is associated with quartz, opal, calcite, barite and pyrite, and occurs in cubic crystals up to 2 mm on an edge, rarely showing tetrahexahedral modifications. Like the melanophlogite occurrences described in the literature, the Parma specimens also contain quartz and/or quartz after opal pseudomorphs, and can be found as overgrowths on these two minerals.

Where pure, melanophlogite crystals are transparent and colorless, with vitreous luster. The Parma melanophlogite, like that from Mount Hamilton (Cooper and Dunning, 1977), shows pyramidal pseudohoppers. It can be found covered by opal in geodes, in association with (or completely covered by) quartz, barite, calcite and opal. Raman Spectrometry studies at the Physics Department of the University of Parma have identified methane within this melanophlogite (D. Bersani, personal communication).

Among other common and interesting minerals there is opal, in vitreous white or blue spheres with a maximum diameter of 1 cm. In thin crusts, it always occurs as the substrate for all the of the other minerals. Quartz occurs rarely in globular aggregates of 1-mm, colorless, prismatic crystals and is not always associated to Melanophlogite.

Barite occurs in subsidiary amounts, in colorless or orange to deep yellow crystals with a maximum size of 1 cm, and calcite is found in white or more often yellow rhombohedral crystals up to 5 mm. Calcite has been found associated with spheroidal opal, but never in association with melanophlogite.



Location Map

Figure 1. **Melanophlogite: cubic crystal 1 mm on edge. F. Adorni collection and photo.**

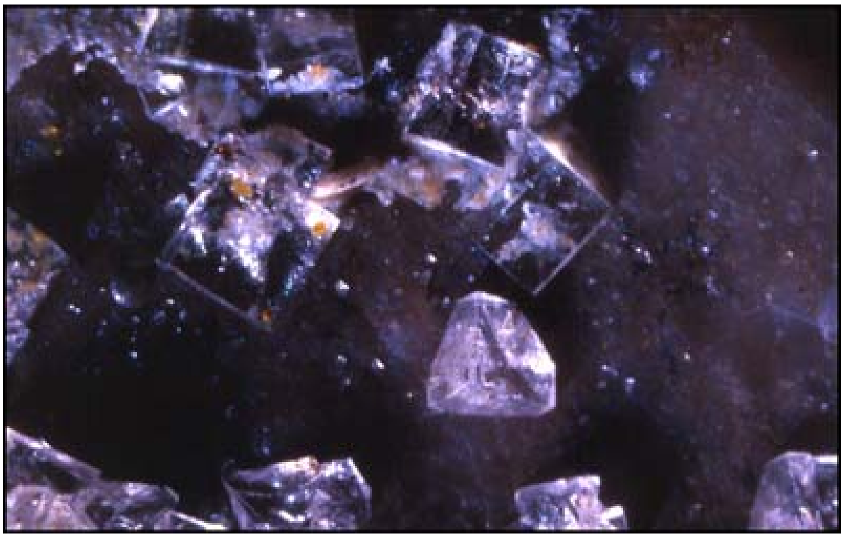


Figure 2. **Melanophlogite: 0.4-mm colorless, limpid cubes. F. Adorni collection and photo.**

Figure 3. **Aggregate of limpid, cubic melanophlogite crystals to 0.5 mm. F. Adorni collection and photo.**

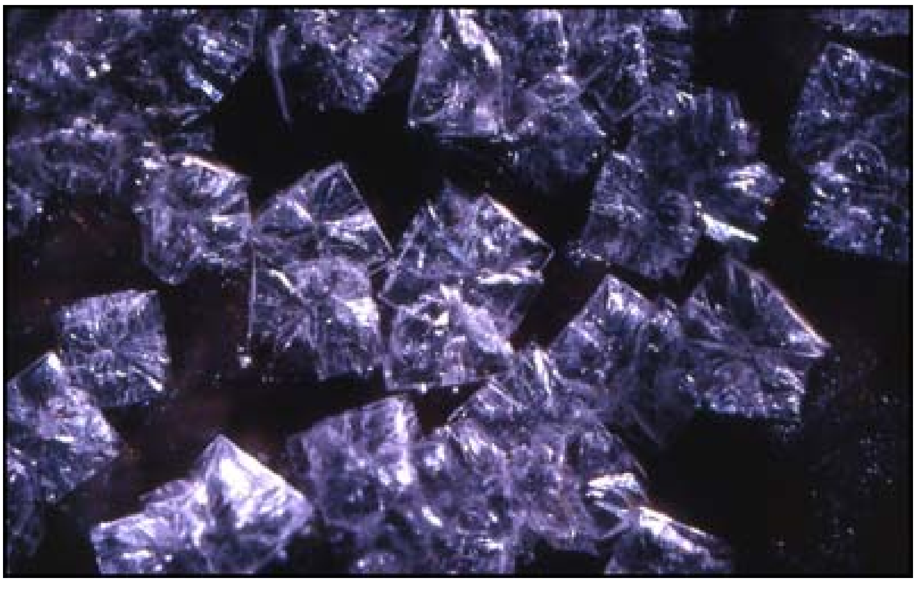


Figure 4. **Melanophlogite cubes to 0.4 mm, with pyramidal pseudohoppers. F. Adorni collection and photo.**

Figure 5. **Melanophlogite crystals to 0.5 mm in geode with opal. F. Adorni collection and photo.**

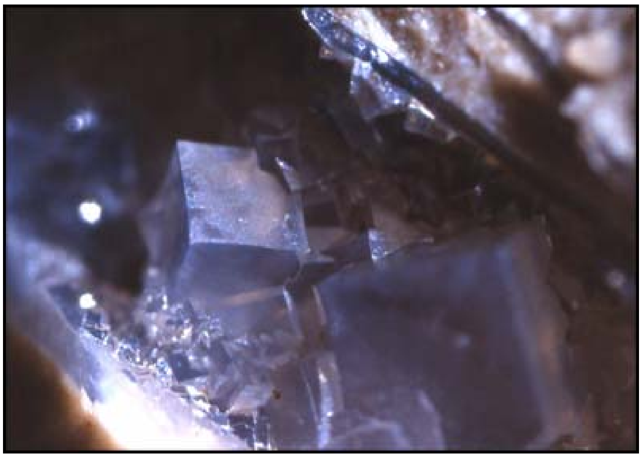


Figure 6. **Colorless and limpid melanophlogite in opal, 0.5 mm. F. Adorni collection and photo.**

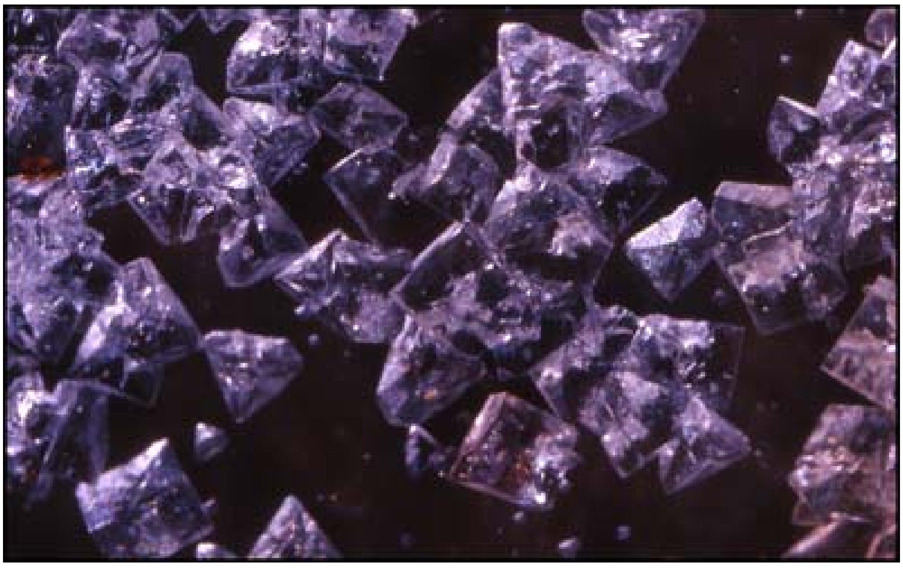


Figure 7. **Melanophlogite cubes to 0.4 mm with pyramidal pseudohoppers. F. Adorni collection and photo.**

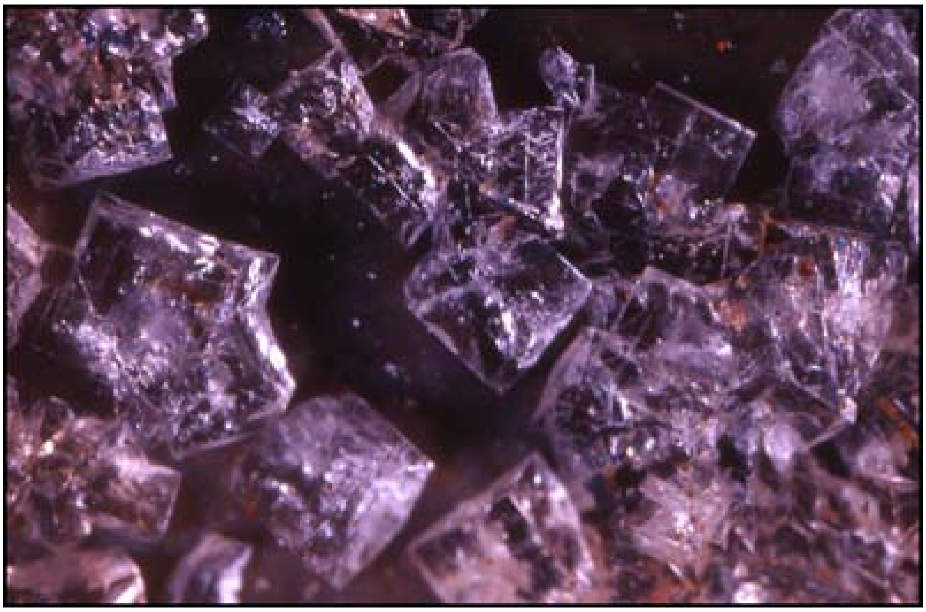


Figure 8. **Perfect, limpid melanophlogite cubes to 0.4 mm on opal. F. Adorni collection and photo.**

Figure 9. **Aggregate of cubic melanophlogite crystals to 0.7 mm, with growing faces. F. Adorni collection and photo.**

Figure 10. **Aggregates of melanophlogite crystals, to 0.7 mm, with growing faces. F. Adorni collection and photo.**

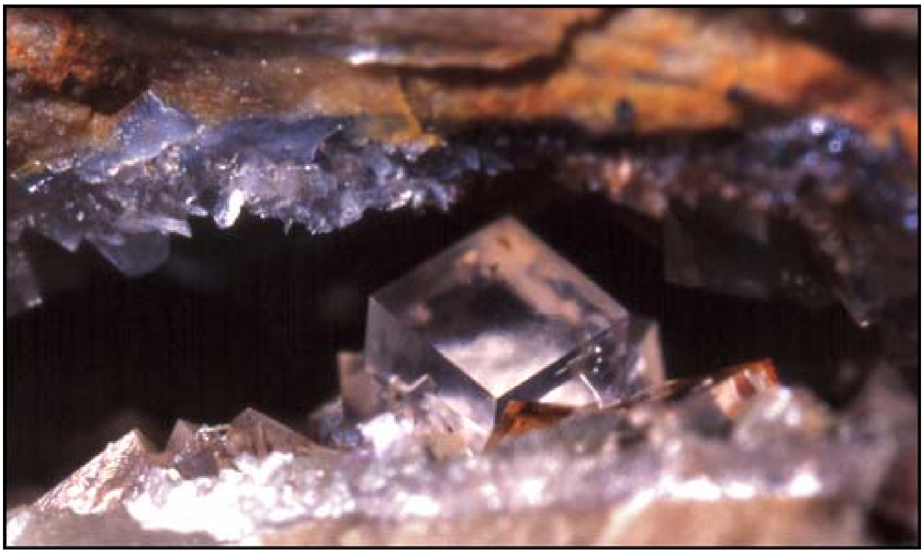


Figure 11. **Colorless and limpid melanophlogite crystal, 0.5 mm, in opal fissure. F. Adorni collection and photo.**

Figure 12. **Melanophlogite crystals to 0.2 mm with internal pseudohoppers. F. Adorni picture and collection.**

Figure 13. **Opal fissure filled with 0.4-mm melanophlogite crystals. F. Adorni collection and photo.**

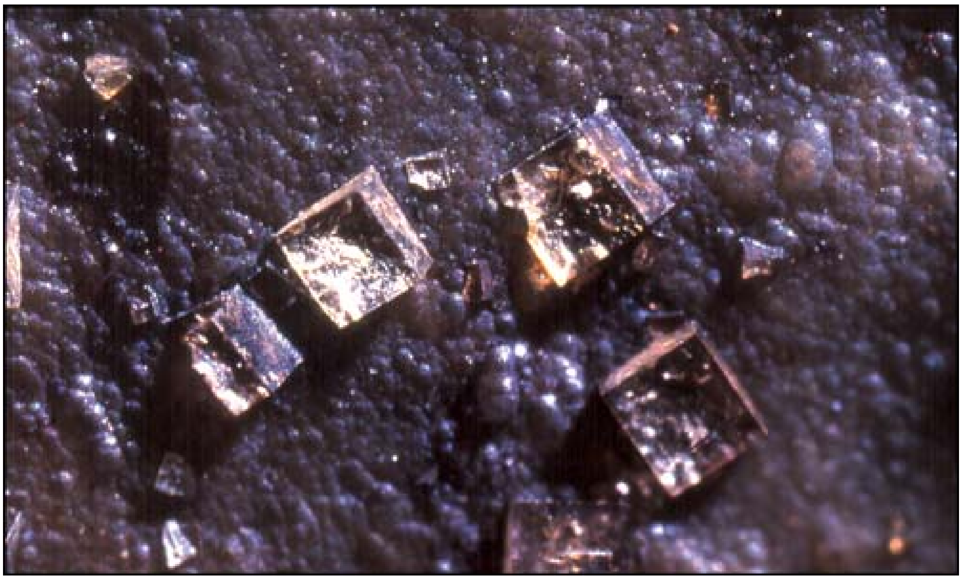


Figure 14. **Limpid, colorless 0.4-mm melanophlogite cubes on opal. F. Adorni collection and photo.**

Figure 15. **Isolated 1-mm melanophlogite crystal in opal fissure. F. Adorni collection and photo.**

Figure 16. **Typical sample from the Case Montanini quarry, with an aggregate of melanophlogite crystals to 0.5 mm on opal. F. Adorni collection and photo.**

Figure 17. **Aggregate of 1-mm orange prismatic barite crystals on opal. F. Adorni collection and photo.**

Figure 18. **A bluish 1-mm opal sphere. F. Adorni collection and photo.**

Figure 19. **A limpid and colorless 1-mm opal spherule. C. Bertini collection and photo.**

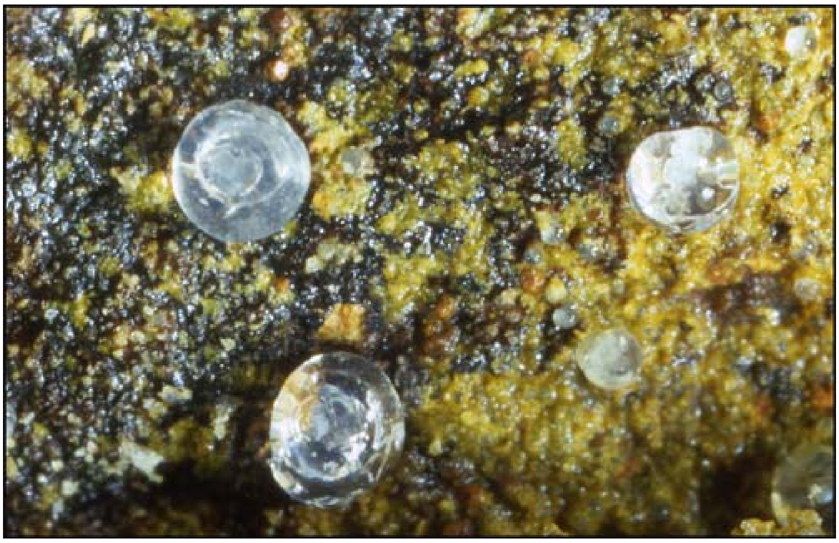


Figure 20. **A colorless 1-mm opal spherule in a fissure. C. Bertini collection and photo.**

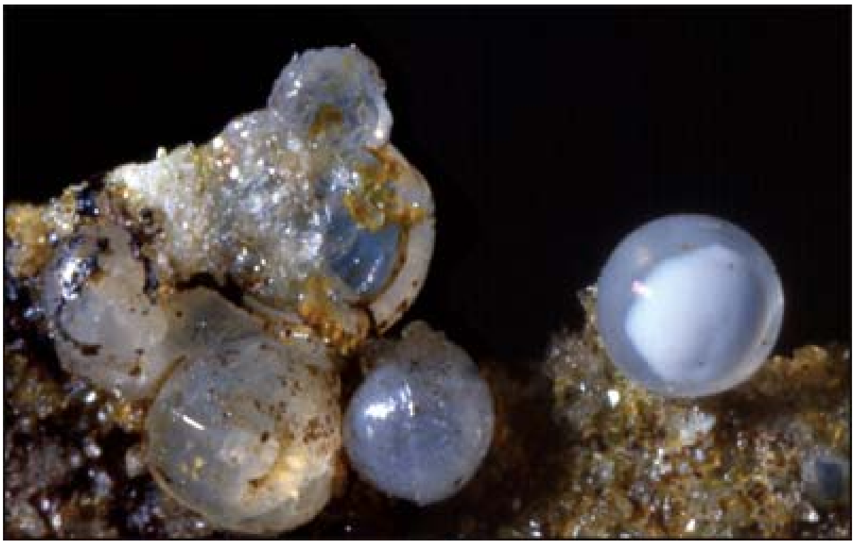


Figure 21. **White 0.8-mm opal spherules with calcite. C. Bertini collection and photo.**

Figure 22. **White opal spherules to 1 mm on a thin opal layer. C. Bertini collection and photo.**

SPECIAL THANKS

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