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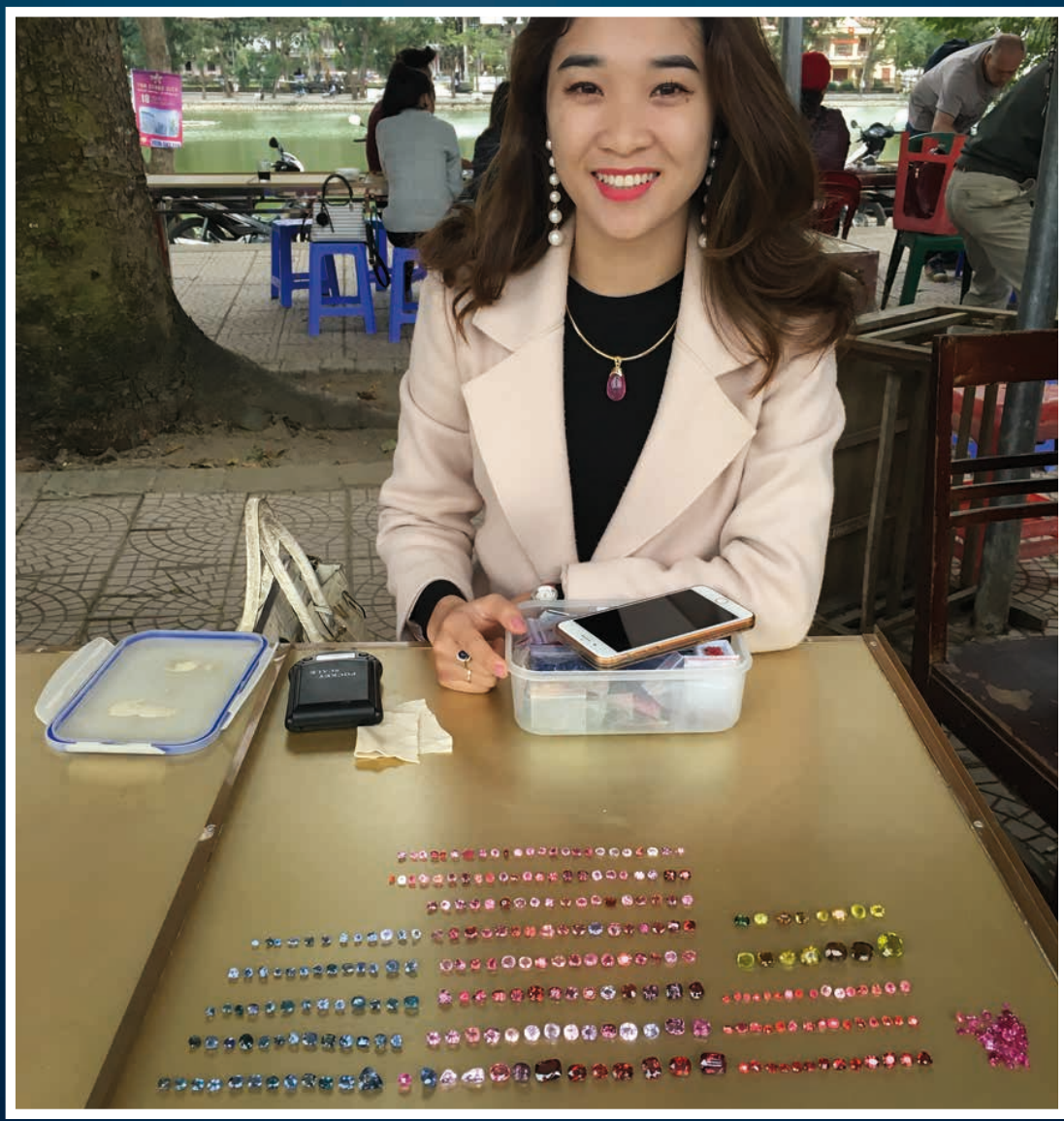

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LA 'ROSE DE MINE': PINK COBALTOCALCITE FROM SWITZERLAND

△ **Figure 1:** Pink cobaltocalcite from the Valais in Switzerland as stalactites on the graphite-rich host rock and as cut and polished specimens investigated for this study. Photo: V. Lanzafame, SSEF

Switzerland is not known for gem deposits, although we have some small outcrops and findings even of ruby and emerald in metamorphosed rocks in the Swiss Alps. Well-known however are Alpine-type hydrothermal mineral formations, e.g. the 'classic' rock crystals with pink fluorite and many other and partly very rare and unique minerals for mineral collectors. All of these minerals formed during the main geological activity of the Alpine orogeny in the late Tertiary about 35-10 million years ago as a result of the collision of the African plate with the Eurasian continent.

Interestingly and very much in contrast to the above, we were able to study in the past few months an ornamental mineral (Figure 1) from Switzerland of an attractive pink colour and translucency, which formed only very recently (in the last 100 years) and at ambient conditions. This mineral crystallized as stalactites in shafts in a now depleted coal mine near Isérables in the Valais, and as such its formation and presence is linked to human mining activity and metal-enriched residual mining waters circulating through these old shafts.

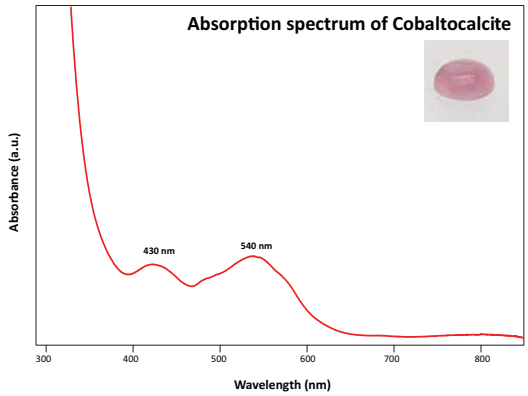
Chemical and structural (Raman spectroscopy) analyses immediately revealed that this material is cobaltocalcite $(Ca,Co)CO_3$, a pink to purple variety of calcite, well-known and appreciated by mineral and gem collectors due to its attractive colour. Cobaltocalcite - mostly found as polycrystalline aggregates – is especially known as a by-product from several ore mines in Africa (e.g. Democratic Republic of Congo) and further mines in Spain, Italy (Elba), and Germany, to name a few.

△ **Figures 2 (left) and 3 (right)** revealing the dense fibrous to mosaic texture of the investigated cobaltocalcite. Photos: M.S. Krzemnicki, SSEF

Under the microscope, the polycrystalline nature of the material was evident, with numerous tiny fibrous crystallites forming botryoidal to stalactitic structures, partly also forming a mosaic-like pattern (Figures 2 and 3).

The chemical analyses (ED-XRF) on two items from this source revealed calcium carbonate as mainly dominating constituent, with minor amounts of Mg and Sr, commonly encountered in carbonates where they replace Ca by a simple substitution process. The cobalt concentration was in both samples very similar (0.167 and 0.159 wt% CoO) with additional traces of zinc (about 2500 ppm), nickel (about 500 ppm), but only very low concentrations of iron (about 100-200 ppm). In contrast to cobaltocalcite described by Siritheerakul and Sangsawong (G&G 2015), the investigated specimens showed no manganese (below detection limit of 100 ppm).

The absorption spectrum on the studied cobaltocalcite samples revealed a characteristic absorption band at about 540 nm with a smaller band at about 430 nm (Figure 4), both attributed to Co^{2+} in octahedral position within the cobaltoalcite structure.



△ **Figure 4:** Absorption spectrum of one of the studied cobaltocalcite samples from Valais, Switzerland with two absorption bands related to cobalt. Figure: M.S. Krzemnicki, SSEF

The occurence of cobaltocalcite in a depleted former coal mine in the Valais (Switzerland) is linked to a series of local Co-Ni-As-Bi mineralisations within the Siviez-Mischabel fold-nappe (Penninic unit) in the Valais, possibly representing primary native metal precipitations reworked by younger Alpine geologic events (Kneissl et al. 2016). The formation of this material as stalactites at ambient conditions is caused by a combination of natural and anthropogenic factors, i.e. carbonate precipitation from Co-enriched meteoric waters and mining activity, similar to by-products found in tailings of other Co-mining districts (Gonzalez-Lopez et al. 2014). Apart from its beauty, this ornamental material thus represents a perfect new addition to the Swiss gem trade (Figure 1), as it is rare, of local occurrence, and has an intriguing history of formation and discovery. It is thus also poetically referred to by the fancy name 'Rose de mine' (English: The Rose of the mine).

Finally, we would like to thank Grégoire Maret (Pierre d'Alexis SA, Geneva) for the supply and donation of this material to the SSEF.

✶ **Dr. M.S. Krzemnicki**