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Tunnelling through the Swiss Central Alps: a museum perspective

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The 57km world record length Gotthard new high speed rail tunnel (AlpTransit) is being excavated in central Switzerland. This giant project presents an unrivalled opportunity to learn more about alpine geology and mineralogy. World-famous mineralogical localities (e.g. Aar and Gotthard massifs) will be crossed at depths. Regional geology is dominated by metamorphic rocks of the lower Penninic units (granitic gneisses) and external crystalline massifs (Aar and Gotthard; gneisses, schists, amphibolites). Finest minerals are usually nested in "Alpine fissure veins".

In order to assure the acquisition and conservation of crystals found during excavation works, provincial governments (Cantons, equivalent to French *Département*) involved by the AlpTransit project decided to clearly state the necessary measures.

In the present paper we will describe the situation in Canton Ticino, the only Canton where a museum of natural history is directly concerned with this project and that hosts 30 of the 57km long drives of planned tunnels. On the basis of the recently approved (2001)-environmental protection law, the Canton Ticino jurisdiction matters as far as rocks and crystal collecting are concerned. Furthermore, in order to define all details regarding the AlpTransit project, an agreement between the main contractor (AlpTransit SA) and Government (Canton Ticino) was signed in 2001. To cope with this engagement a part-time job for a geologist has been created at the museum where all the sampled materials are going to be stocked. Duties envisaged for this job include regular inspections at construction sites, sampling of rock and crystals, cleaning and conservation of specimens, exhibition and publication of most relevant discoveries. Another important task is to make the workers of this international joint venture contractor aware of the scientific wealth of crystals in order to avoid picking of valuable material.

Currently, just over 5km of twin main tunnels are excavated (predominantly by a hard rock TBM with a 8.8m diameter) in the first section in Ticino. Up to now the monotonous lower Penninic granitic gneisses did not host important fissure veins and only a few small-sized samples were collected. Locally, unfavourable geological conditions related to the crossing of kakirite zones (fault breccias and fault gouge) complicated the whole scenario. Nevertheless nineteen phases have been identified. As expected, major discoveries will probably be done towards the northern section, when the Gotthard massif will be crossed.

New type minerals from Galiléia, Minas Gerais, Brazil:coutinhoite and lindbergite.

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The municipality having the largest number of Brazilian type minerals is Galiléia, Minas Gerais. There, the Sapucaia mine has been considered the type locality for frondelite, faheyite, moraesite, avelinoite, barbosalite, tavorite, and lipscombite. However, avelinoite has been discredited as identical to cyrilovite, and "lipscombite" from Galiléia, with Mn or Fe^{3+} predominant over Fe^{2+} in the A-site, has a different chemical composition from the synthetic compound previously named as lipscombite. Hence, the Czech Republic mineral, with the same composition as the original synthetic lipscombite, should be considered as the true type specimen for lipscombite. Coutinhoite (Atencio et al. 2004a) and lindbergite (Atencio et al. 2004b) are two new minerals now described from Galiléia. Coutinhoite, ideally $Th_xBa_{(1-2x)}(H_2O)_y(UO_2)_2Si_5O_{13}\cdot H_2O$, with $0\leq x\leq 0.5$ and $0\leq y\leq(2+x)$, occurs as a secondary hydrothermal mineral in the Córrego do Urucum granitic pegmatite, Lavra Urucum, Galiléia. The mineral forms irregular aggregates with very small curved scales, flaky crystals, up to 10 μm long and a thickness up to about 0.5 μm. Coutinhoite is transparent to translucent and displays a waxy to silky lustre; colour and streak are yellow. It is non-fluorescent. The mineral is orthorhombic, probable space group Cmmb. It is probably isostructural with weeksite. Coutinhoite is intimately associated with weeksite, phosphuranylite, meta-uranocircite and uranocircite on muscovite and microcline. Lindbergite, $Mn(C_2O_4)\cdot 2H_2O$, is a secondary mineral in the Lavra da Boca Rica granite pegmatite, Sapucaia do Norte, Galiléia. It occurs as: (1) white short prismatic crystals 0.1 to 0.3 mm, interpreted as pseudomorphous after the orthorhombic trihydrate, with faces of {100}, {hk0}, {010}, and {0kl} forms, rounded edges and twinning on (010); (2) grayish white aggregates in 0.1 mm thick translucent crusts made up of interlocked irregularly contoured platelets up to 0.03 mm in length. Lindbergite is transparent, has a white streak, vitreous lustre, a perfect cleavage parallel {010}, and is non-fluorescent. The mineral is monoclinic, C2/c. Lindbergite is the Mn-analogue of humboldtine and glushinskite. Associated minerals are the phosphates triphylite, phosphosiderite, frondelite, strengite, cyrilovite, bermanite, rockbridgeite, huréaulite, tavorite, reddingite, heterosite, laueite, and unidentified minerals.

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Composition of some pegmatitic, hydrothermal and metamorphic dravites from the Urals, Russia

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Tourmaline is stable over a wide range of conditions from low temperature hydrothermal alteration to high grade and high pressure metamorphic environments, and magmatic conditions. We have studied chemical composition of tourmalines from different geological environments in the Urals, including desilicified pegmatite (Lipovskaya mine), the phlogopite schist and other alterations in the Emerald mines, propylitic- and listwaenitic-type alterations and related veins at the Berezovskoye Au and the Shabrovskoye talc deposits situated in the Middle Urals, Syrostanskoye talc deposit, Elenovskoye Cu-tourmaline deposit, and Kochkarskoye Au deposit in the South Urals, the Chudnoye Au deposit in the Polar Urals.

Tourmaline from desilicified pegmatite in the Lipovskaya mine associates with carbonate, andesine, green phlogopite and chrysoberyl. On the basis of classification by Hawthorne & Henry (1999) the tourmaline is a variety between dravite-uvite endmembers with the $Fe_{tot}/(Fe_{tot}+Mg)$ ratio (Fe) no more than 0.10, the Ca/(Ca+Na) ratio (Ca) is up to 0.8. Tourmaline contains up to 0.30 apfu F.

In the Emerald mines tourmaline associates with hornblende and different F-bearing phyllosilicates, including phlogopite, paragonite, margarite, and chlorite. In different association tourmalines differ by the Fe, Ca values and the F amounts in the W site. The Fe value in dravite from the earliest albite-hornblende alteration ranges from 0.15 to 0.22. It is characterized by the low F content (0.00-0.10 apfu). F content in dravite from usual emerald-bearing phlogopite schists ranges from 0.00 to 0.38 apfu; the Fe and Ca values range from 0.16 to 0.28 and from 0.17 to 0.36, respectively. Tourmaline from quartz-fluorite-tourmaline-phlogopite-plagioclase pockets and veinlets is dravite to "fluordravite" (0.23-0.52 apfu F) with the Fe and Ca values ranging from 0.21 to 0.30 and from 0.15 to 0.27. Tourmaline associated with the Fe-free phlogopite and paragonite cementing brecciated chromium spinel crystals is F-dominated (up to 0.77 apfu) with the very low Fe value ranging from 0 to 0.01. Dravite associated with paragonite, margarite and topaz is F-dominated (up to 0.77 apfu) with the Fe value ranging from 0.24 to 0.32. Newly formed tourmaline from margarite veinlets cutted phlogopite schists is a variety between dravite-"fluordravite" endmembers with the F content, the Fe and Ca values ranging from 0.04 to 0.71apfu, from 0.19 to 0.41, and from 0.06 to 0.16, respectively. Tourmalines from carbonate-muscovite-chlorite veinlets are F-poor. The Fe value ranges 0.25 to 0.37. The Fe^{3+}/Fe_{total} ratio in the Emerald mines tourmalines ranges from 0.03 to 0.07. Formation temperature for the tourmaline bearing associations estimated from the biotite-tourmaline (Colopietro & Friberg, 1987) and chlorite (Cathelineau, 1988) thermometers is 320-490°C.

Tourmaline from the propylitic-type alteration and related veins at the Berezovskoe and Zolotaya Gora Au deposits, and Shabrovskoye and Syrostanskoye talc deposits associates with the same phyllosilicates as well as in the Emerald mines. However both phyllosilicates and tourmalines are F-free. The W site of these tourmalines is dominated by OH^- or O^{2-}. The X site is dominated by Na or vacancy (up to 0.55 apfu). The Fe value ranges from 0.08 to 0.40. In Berezovskoe tourmaline associated with Ni-talc contains Ni up to 0.53 apfu. The Fe^{3+}/Fe_{total} ratio for above tourmalines is about 0.5. Based on calculations the tourmaline can be classified as variety between the magnesiofoitite-foitite-dravite-shorl endmembers. Formation temperature of the propylitic tourmalines evaluated from above thermometers ranges from to 250 to 380°C. Tormaline from Elenovskoye is a variety between shorl-dravite endmembers. The Fe and Ca values range from 0.32 to 0.53 and from 0.09 to 0.71. Chemical composition of the tourmaline is that for porphyry-copper deposits.

F-free tourmaline from the listwaenitic-type alteration and related veins occurring Berezovskoye associates with quartz, dolomine, pyrophyllite, and pyrite. The W site of the tourmaline is dominated by OH^- or O^{2-}, ranging 0.12 to 0.93 and from 0.18 to 0.88, respectively. The X site is dominated by Na or vacancy ranging from 0.34 to 0.87 and from 0.12 to 0.65, respectively. The Fe value ranges from 0.08 to 0.12. This tourmaline can be classified as variety between the magnesiofoitite-dravite endmembers. Formation temperature of the tourmaline estimated from fluid inclusions in associated quartz is 300-330°C.

Tourmaline from the contacted metamorphosed hydrothermal alteration in the Kochkarskoye Au deposit and host schist in the Chudnoye Au depositi is shorl-foitite to dravite-magnesiofoitite with the *Fe* value and Na (apfu) ranging from 0.21 to 0.72 and from 0.27 to 0.92, respectively

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Fersman museum database information system - a tool for collections management, scientific attribution of mineral specimens and new acquisitions.

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