

THE CRYSTAL STRUCTURE OF TYROLITE, $\text{Ca}_2\text{Cu}_9(\text{AsO}_4)_4(\text{CO}_3)(\text{OH})_8(\text{H}_2\text{O})_{10}$:
SYNCHROTRON X-RAY DIFFRACTION STUDY

Krivovichev, S. V.^{1,2}, Chernyshov, D. Yu.³, Döbelin, N.⁴, Kahlenberg, V.², Tessadri, R.²,
Armbruster, T.⁴ & Kaltenhauser, G.²

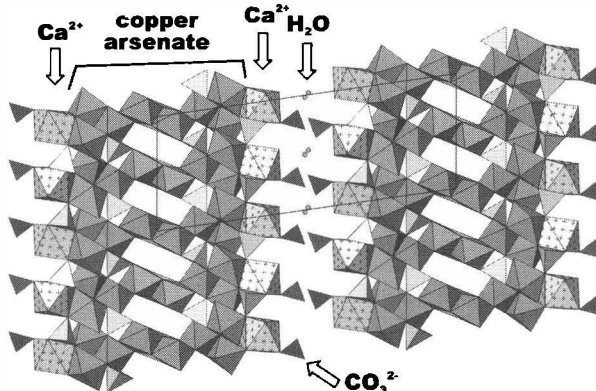
¹ Department of Crystallography, Faculty of Geology, St.Petersburg State University, St.Petersburg 199034, Russia

² Institut für Mineralogie und Petrographie, Universität Innsbruck, Innrain 52, A-6020 Innsbruck, Austria

³ Swiss-Norwegian beamline, European Synchrotron Radiation Facility, BP 220, Grenoble 38043, France

⁴ Laboratorium für chemische und mineralogische Kristallographie, Universität Bern,
Freiestrasse 3, CH-3102 Bern, Switzerland
e-mail: skrivovi@mail.ru

Tyrolite, $\text{Ca}_2\text{Cu}_9(\text{AsO}_4)_4(\text{CO}_3)(\text{OH})_8(\text{H}_2\text{O})_{10}$, is common mineral from oxidation zones of sulfide mineral deposits. First described from Schwaz-Brixlegg locality in Tyrol, Austria, it has been subsequently reported for about 128 localities all over the world. Tyrolite was described as orthorhombic, $a = 10.212$, $b = 55.510$, $c = 5.602$ Å, $V = 3175.6$ Å³ [PDF # 11-348]. In 1980, a monoclinic tyrolite-like mineral was reported by MA et al. (1980) from Dongchuan copper mine, Yunnan Province, China. The mineral had the same chemistry as tyrolite but was identified as monoclinic, $a = 10.513$, $b = 5.560$, $c = 27.610$ Å, $\beta = 94$, $V = 1609.9$ Å³. The mineral was named 'clintyrolite' but it has not been approved by the CNMMN IMA. For this study, a crystal from the type locality (Schwaz in Tyrol) was selected. X-ray diffraction experiments were performed at the Swiss-Norwegian beamline BM01 of the ESRF with an imaging plate area detector Mar345. We have found tyrolite to be monoclinic, $P2_1/c$, $a = 27.562(3)$, $b = 5.5682(7)$, $c = 10.466(2)$ Å, $\beta = 98.074(11)^\circ$, $V = 1590.3(3)$ Å³. There are five Cu(II) sites in Jahn-Teller-distorted octahedral coordinations to six anions. The structure (Figure) is based upon 2nm-thick copper arsenate layers with complex architecture. The layers are insulated by Ca^{2+} cations, CO_3^{2-} groups and H_2O molecules. The layers are held together by hydrogen bonds only.



References

[1] MA, Z., QIAN, R.Y., PENG, Z.-Z. (1980): Dizhi Xuebao, 54, 134-143.