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## **Zirkelite from the Sebl'yavr carbonatite complex, Kola Peninsula, Russia; an X-ray and electron microprobe study of a partially metamict mineral**

**A. G. Bulakh, A. R. Nesterov, I. S. Anisimov, and C. T. Williams**

*Saint Petersburg State University, Mineralogy Department, Saint Petersburg, Russian Federation*

Zirkelite, a cubic mineral of general formula  $(\text{Ti, Ca, Zr})\text{O}(\text{sub } 2-x)$  occurs as an accessory mineral in phosphorites, carbonatites and associated rocks in the Sebl'yavr complex. After pyrochlore, it is the main mineral concentrating niobium in these rocks. Zirkelite forms platy crystals comprising polysynthetic octahedral twins, often having a complex skeletal internal structure within a cuboctahedral external morphology. The mineral is largely metamict, but after heating to 800 degrees C it produces a cubic crystalline structure with  $a_0 = 5.157+ \text{ or } -0.006 \text{ \AA}$ . It is black to brownish-black in colour, VHN = 760-780 kg.mm (super -2), density = 4.27 g.cm (super -3), and reflectance = 12.5%. Chemically, zirkelite is relatively enriched in  $\text{Nb}_2\text{O}_5$  (up to 14.5 wt.%) and  $\text{ThO}_2$  (up to 7.7 wt.%), and it displays four compositionally-distinct zones which probably formed during primary crystallisation processes. It is patchily altered where it is associated with an unidentified Ba, Ti, Nb, Zr silicate phase which partly replaces and pseudomorphs it. Under the current IMA-approved nomenclature scheme, non-crystalline (metamict) minerals of the composition described here would normally be given the general species name zirconolite, with the name zirkelite confined to the cubic mineral. However, at Sebl'yavr, the name zirkelite is used because the mineral displays a well-defined cubic crystal morphology and has a cubic structure after heating.