Kosmochlor-bearing jadeite rocks from Kenterlau-Itmurundy (Lake Balkhash, Kazakhstan)

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Petrographic, petrologic and geochemical investigations on Cr-jadeite rocks from Kenterlau-Itmurundy near Lake Balkhash (Kazakhstan) reveal five different rock groups. *Jadeitites* show irregular, medium-grained white sections made up of decussate jadeite crystals and fine-grained sections made up of aligned Cr-jadeite. *Omphacite jadeitites* show a homogeneous, pale green colour with randomly oriented jadeite crystals, which are overgrown by omphacite on their rims and along fractures. *Phlogopite-analcime jadeitites* show decussate, white sections made up of jadeite and foliated, partially microfolded green layers and spots consisting of Cr-jadeite. Analcime and phlogopite formed late in fractures in the jadeite-rich sections. *Phlogopite-omphacite jadeitites* reveal an inhomogeneous mineral distribution with a dark-green matrix made up of sheaf-like aggregates of Cr-omphacite and white spots of decussate prismatic jadeite crystals. Post-crystallization deformation is evident by bent and twisted pyroxenes while phlogopite formed post-tectonically on fractures and grain boundaries. Due to the extreme textural inhomogeneity, transitions between these four groups are blurred. *Kosmochlor-analcime-albite-omphacite jadeitites* reveal an inhomogeneous fabric with decussate, white sections, pale-green shear bands, and dark green layers. Again, white jadeite-rich sections formed pre-tectonically while shear bands display aligned Cr-omphacite, and in rare cases small aggregates of kosmochlor (identified by Raman spectroscopy, see Fig. 1). The main occurrence of kosmochlor is in the dark green layers, where it mantles strongly corroded chromite grains (Fig. 2). Microprobe investigations of two kosmochlor-bearing rocks and one phlogopite omphacite jadeitite reveal extreme mineral compositional variability. Pyroxene zoning with jadeite cores and rim sections of omphacite or Cr-omphacite are wide spread. Similarly, kosmochlor aggregates are very inhomogeneous covering a wide range in the pyroxene plots (Figs. 3 A&B). Similar textures have been observed by other investigations (e.g. Shi et al., 2005) and are due to pre-, syn- and post-tectonic crystallization processes. Distinct inhomogeneities are also revealed by ED-XRF spot analyses, which show a strong compositional variability from section to section.

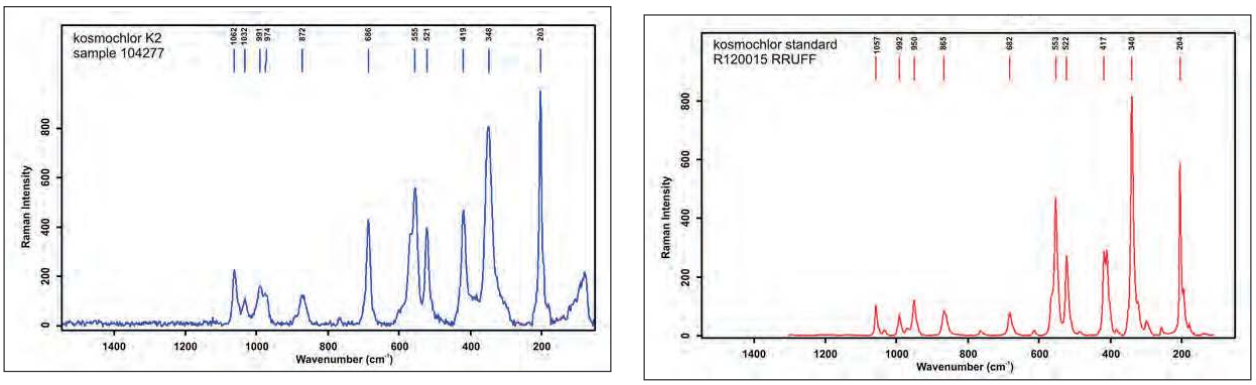

Figure 1. Raman spectra of kosmochlor from sample 104277 and of kosmochlor standard R120015 from the RRUFF database.

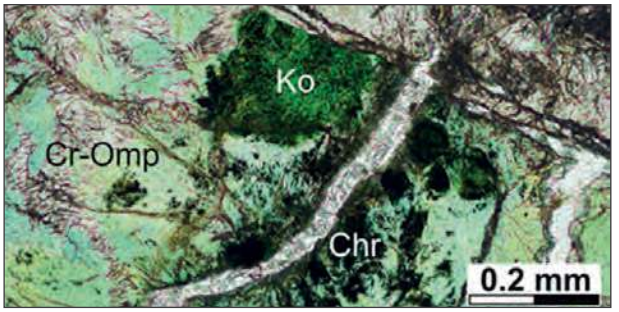

Figure 2. Microphotograph of sample 104277 (II polarizers) showing kosmochlor-aggregates (Ko) with chromite (Chr) surrounded by Cr-omphacite (Cr-Omp), Cr-jadeite (Cr-Jd) and jadeite (Jd) in. Fractures are filled with albite and analcime.

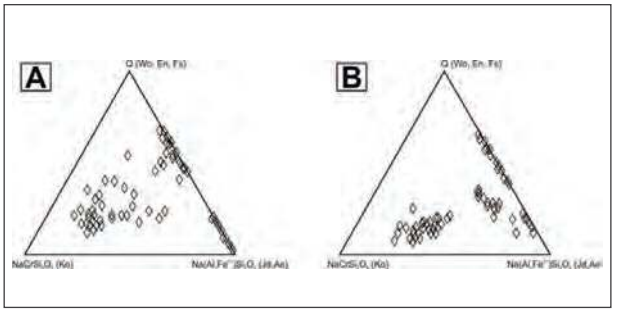

Figure 3. Microprobe analyses from the kosmochlor-bearing samples 104276 (A) and 104277 (B) reveal the great compositional variability of pyroxene in these rocks.

As evident from these investigations, nearly pure jadeite formed pre-tectonically. During subsequent deformation, Ca- and Cr-rich fluids led to the formation of omphacite, Cr-omphacite, Cr-jadeite and eventually to kosmochlor. The largest modal amount of kosmochlor formed pre- and syn-tectonically in chromite-bearing layers of the rocks. Analcime, albite and phlogopite formed post-tectonically and during late brittle deformation.
Until now, terrestrial kosmochlor has been described from Burma (Ou Yang 1984; Hänni & Meyer 1997), New Zealand (Ikehata & Arai 2004), Japan (Anthony et al., 1995), Kola peninsula and Lake Baikal, Russia (Zozulya et al. 2003; Reznitskii et al., 1999). Similar to these occurrences, the presence of kosmochlor in Cr-rich jadeitites from Kenterlau-Itmurundy, is explained by appropriate rock composition, pervasive HP/LT conditions (i.e. 600°C at 1.2 GPa; Dobretsov & Ponomareva 2009). According to their rock fabrics and to the geology of the area we interpret the Kazakhstan jadeitites as P-types as defined by Tsujimori & Harlow (2012).

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