

## TITANIUM SILICATES AND SILICOPHOSPHATES FROM KOLA PENINSULA: CRYSTAL CHEMISTRY AND SOLID STATE NMR SPECTROSCOPY

<sup>1</sup>SHERRIFF, B.L., <sup>2</sup>SOKOLOVA, E.V., and <sup>3</sup>KHOMYAKOV, A.P. <sup>1</sup>Dept. of Geol. Sci., Univ. of Manitoba, Winnipeg, Canada; <sup>2</sup>Fac. of Geol., Moscow State Univ., Moscow, Russia; <sup>3</sup>Inst. Miner. Rare Elements, Moscow, Russia.

In the hyperalkaline rocks of the Khibiny and Lovozero massifs (Kola Peninsula, Russia) more than 500 minerals have been described, 140 of them being new mineral species. Among these minerals are a series of Ti-silicate minerals which are of great interest because of the catalytic potential of these porous zeolite-type of structures. The series includes orthosilicates such as sitinakite  $\text{Na}_2\text{KTi}_4\text{Si}_2\text{O}_{13}(\text{OH}) \cdot 4\text{H}_2\text{O}$  and its hydrated derivative, and labuntsovite  $(\text{K}, \text{Ba}, \text{Na})(\text{Ti}, \text{Nb})(\text{Si}, \text{Al})_2(\text{O}, \text{OH})_7\text{H}_2\text{O}$ , and complex chain silicates such as vinogradovite  $\text{Na}_4\text{Ti}_4\text{O}_4[\text{Si}_2\text{O}_6]_2[\text{Si}_4\text{O}_{10}] \cdot n\text{H}_2\text{O}$ , narsarsukite  $\text{Na}_2(\text{Ti}, \text{Fe}^{3+})\text{Si}_4(\text{O}, \text{F})_{11}$ , fersmanite  $(\text{Ca}, \text{Na})_4(\text{Ti}, \text{Nb})_2\text{Si}_2\text{O}_{11}(\text{F}, \text{OH})_2$ , vuonnemite  $\text{Na}_5\text{TiNb}_2(\text{Si}_2\text{O}_7)_2\text{O}_3(\text{F}, \text{OH})_2\text{Na}_3\text{PO}_4$ , and the 1M and 2O polytypes of penkvilksite  $\text{Na}_4\text{Ti}_2\text{Si}_8\text{O}_{22} \cdot 4\text{H}_2\text{O}$ . Solid state  $^{29}\text{Si}$ ,  $^{23}\text{Na}$  and  $^{27}\text{Al}$  MAS NMR spectra and X-ray structural refinements will be presented to elucidate the understanding the properties of this important group of minerals.  $^{31}\text{P}$  MAS NMR data will also be presented for nacaphite  $\text{Na}_2\text{CaPO}_4\text{F}$  and its synthetic polymorph, lomonosovite  $\text{Na}_2\text{Ti}_2\text{Si}_2\text{O}_9 \cdot \text{Na}_3\text{PO}_4$ . In the crystal structures of nacaphite (triclinic symmetry)  $^{23}\text{Na}$  and  $^{31}\text{P}$  MAS NMR spectra indicate a higher degree of atomic ordering in contrast to the synthetic polymorph (hexagonal symmetry).