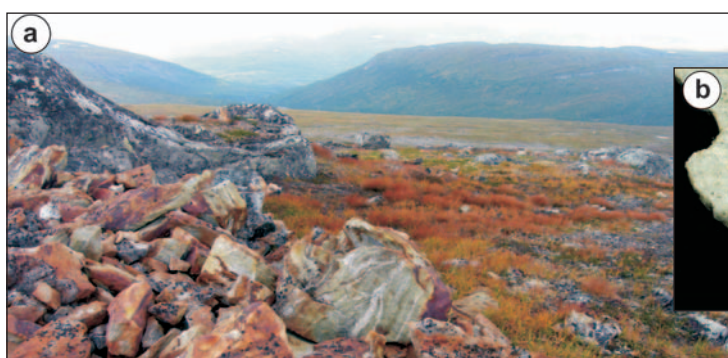




Focus on Mineral Resources

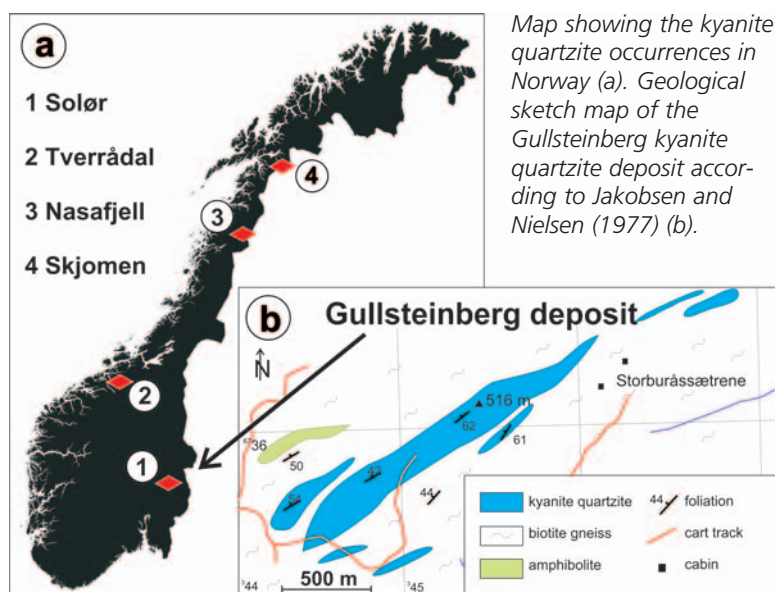
Norwegian kyanite quartzites

High purity quartz and aluminium deposits



View from the southern flank of Nasafjell with kyanite quartzite boulders in the foreground (a). Fine-grained turquoise kyanite quartzite hand specimen from Solør (b).

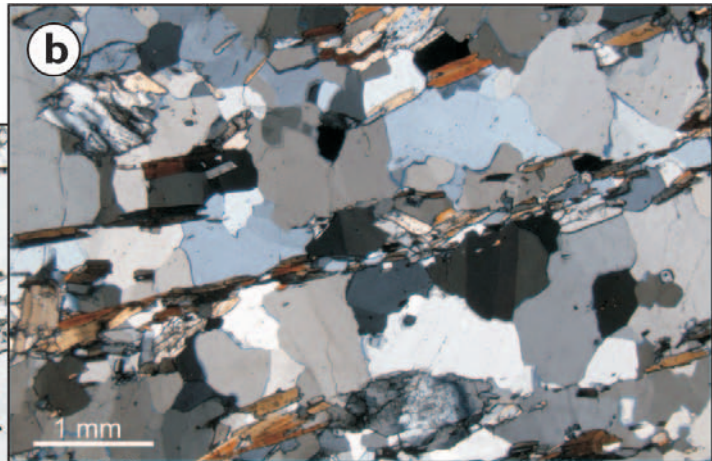
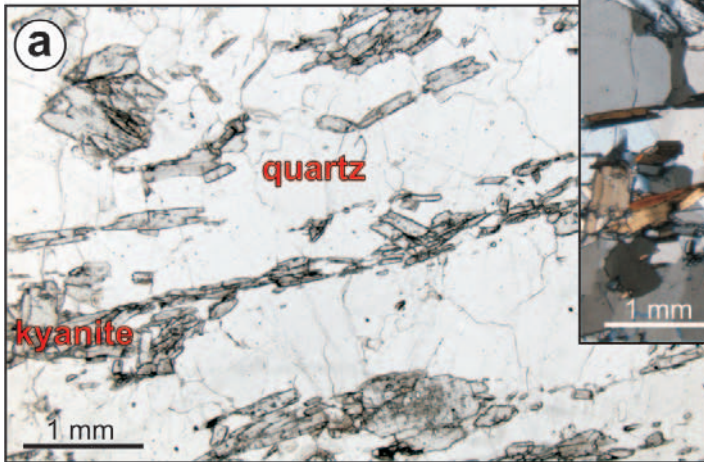
Kyanite quartzites are fine-grained quartzites containing 70 to 85 vol.% quartz (SiO_2) and >15 vol.% kyanite (Al_2SiO_5). Common accessory minerals in kyanite quartzites are rutile, zircon, pyrite and other Fe-Ti-bearing oxides as well as sulfides. Kyanite quartzites form stratiform lens-shaped bodies, extending over several kilometers, commonly associated with metamorphic acidic to intermediate volcanic and subvolcanic rocks. Alternatively they may be associated with mafic volcanites and intrusions of island arc setting (e.g., Ihlen 2000, Larsson 2001). The rocks are affected by upper greenschist to amphibolite facies metamorphism (>420°C and >2.8 kbar).



The largest kyanite quartzite bodies in Norway occur in the Solør area at Gullsteinberget, Knøsberget, Kjeksberget and Sormbrua, with a length of up to 2 km and a thickness of several hundred meters. About 30 small bodies (20 to 100 m in length) are exposed in the Skjomen area, a nearly 70 km long folded zone of muscovite-rich rocks with lenses of kyanite quartzites are known from Nasafjell and a minor body occurs at Tverrådalen in the Surnadal area. Traditionally, kyanite quartzites have been mined for kyanite in the USA. Kyanite is raw material for high-alumina refractories forming the inner lining of furnaces and high-temperature vessels widely used in the production of metals, ceramics, glass and cement.

Recently, it was discovered that several kyanite quartzites in Norway contain high purity quartz (Wanvik 2004, Müller et al. 2005). High purity quartz (HPQ) is becoming a strategic industrial mineral and its worldwide demand is increasing because it is needed for a wide range of special applications in the high-tech industry. HPQ contains less than 50 ppm of impurities, comprising structure-bound trace elements (B, Li, Al, Ge, Ti, Fe, Ca, K, Na, P) within the quartz lattice, but also micro-inclusions of minerals and trapped hydrothermal fluids.

Microphotograph of fine-grained kyanite quartzite. Planepolarized light.



Microphotograph of fine-grained kyanite quartzite. Crossed polarized light.

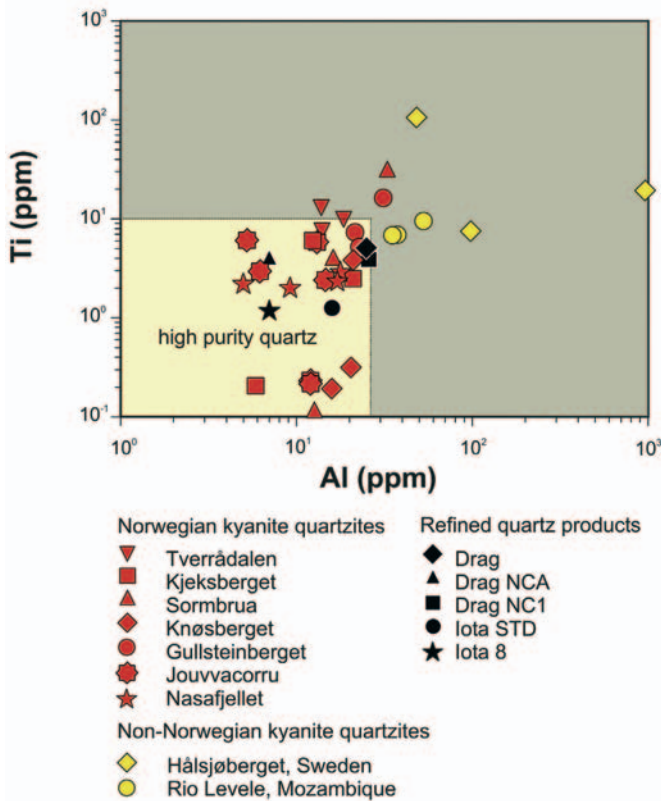


Diagram of the Al vs. Ti concentration in quartz of kyanite quartzites from Norway, Sweden and Mozambique (Müller et al. 2005) determined by laser ablation inductively coupled mass spectrometry and of refined high quality quartz products produced in Norway (Drag, Drag NCA, Drag NC1; www.norcryst.no) and USA (Iota STD, Iota 8; www.iotaquartz.com). Concentrations of <25 ppm Al and <10 ppm Ti are considered as "high purity".



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