

## Garnet ships in a quartzite sea

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During progressive deformation, a strong inclusion in a weaker matrix causes a stress concentration that may result in strain localization, seen in a matrix grain-size reduction. A superb example of this phenomena, but rather more complex, has been observed in north Norwegian Caledonides. A probably subvertical metadolerite dyke has been rotated to lie parallel to the penetrative regional low-angled foliation during the emplacement of the overlying nappe. The metadolerite, now only ~1.4 cm thick and lying between two quartzite layers has been retrogressed to a biotite schist with an assemblage of biotite, titanite, epidote group, garnet and quartz. Garnets are from 0.2 mm to 4 cm in size, subhedral and have two growth zones, with inclusions of predominantly titanite and rare amphibole. The country-rock metasedimentary schists contain staurolite, indicating mid-amphibolite-facies conditions (~550 °C and 6 kbar). During late deformation, some garnets were forced into the quartzite, resulting in the development of pronounced gouges (tectoglyphs), up to 70 mm long, 14 mm wide and 14 mm deep, deepening in the direction of movement. Quartz was pushed up at the sides of the gouges and forms a pronounced bow-wave at the front of the garnets. Where garnets are gouged into the quartzite, intense strain localization occurs. Both in front of and under the garnet, a up to 18 mm wide zone of quartz mylonite developed. The mylonitic foliation curves around the garnet, with a relatively sharp boundary to the adjacent quartzite that preserves an older random fabric. Deformation in the mylonite, which shows a strong crystallographic preferred orientation, seems to have occurred by (1) intense dislocation glide followed by (2) subgrain rotation resulting in an almost foam-like fabric. The grain size of the mylonite (at the quartzite-biotite schist interface) increases with increasing distance behind the present position of the garnets. This observation is consistent with an expected increasing stress gradient towards the garnet porphyroclast. So far, the specific mechanism causing the gouging of garnets into the quartzite and the development of the tectoglyphs is unclear.