Photoluminescence recovery upon annealing of fergusonite

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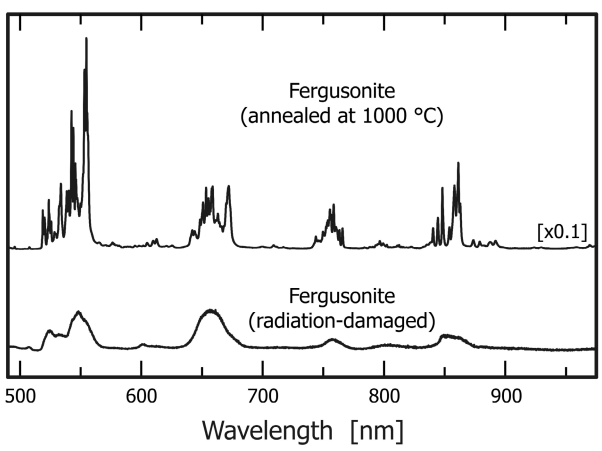
Fergusonite [general formula $YNbO_4$], due to its actinide content, is commonly found in the metamict state. In dry annealing experiments, the majority of structural recovery occurs at temperatures of >800 °C (Tomašić *et al.*, 2006). This process involves intermediate formation of tetragonal α-fergusonite below ~1000 °C and monoclinic β-fergusonite above this temperature.

We have studied changes in laser-induced photoluminescence (PL) spectra, which are dominated by emissions of centres related to rare-earth elements (REE), upon gradual reconstitution of the crystallinity. For this, a metamict fergusonite sample from Madagascar (Th 1.9 wt%, U 4.3 wt%) was subjected to dry annealing for 100 h at different temperatures. Analogous to observations on annealed zircon (Nasdala *et al.*, 2002), annealed fergusonite yields considerably intensified PL (Fig. 1). General sharpening of bands at higher annealing temperatures is due to increasing crystal field effects and indicates recovery of the fine structure.

Figure 1: Photoluminescence spectra of natural and annealed fergusonite, dominated by trivalent REE (Nd, Er, Pr, Ho, Tm) emissions.



References

Nasdala L., Lengauer C.L., Hanchar J.M., Kronz A., Wirth R., Blanc P., Kennedy A.K. and Seydoux-Guillaume A.M., (2002), *Chem. Geol.* **191**, 121–140.

Tomašić N., Gajović A., Bermanec V., Su D.S., Rajić Linarić M., Ntaflos T. and Schlögl R., (2006), *Phys. Chem. Minerals* **33**, 145–159.

Worlds frozen in time: Dawn explores 1 Ceres and 4 Vesta

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Dawn is a low-cost planetary mission that uses ion propulsion to rendezvous with and orbit the two most massive members of the asteroid belt, 1 Ceres and 4 Vesta. Our current understanding of Ceres is based almost entirely on remote sensing while our understanding of Vesta is based predominantly on cosmochemical evidence obtained from the Howardite-Eucrite and Diogenite meteorites. These data suggest that these two bodies are quite dissimilar: Ceres being wet with perhaps a 100 km thick ice mantle covered with dust and Vesta being dry with a basaltic surface similar to the moon. Both bodies have clearly undergone thermal evolution to reach their current state but, we believe, did so rapidly in the first 1 – 3 million years of the early solar system well before the larger terrestrial planets were formed. The surfaces of these two survivors of the collisional environment established with the formation of the gas giants have remained frozen in time allowing the Dawn mission to effectively travel not only in space but also take us backward in time to learn the conditions at the earliest epoch of our solar system. Dawn carries redundant framing cameras, a visible infrared mapping spectrometer and a gamma ray and neutron detector. These instruments together with radiometric data provide geologic context, minerological data, elemental composition and internal structure. Vesta will be orbited in 2011 and Ceres in 2015.