Paper Number: 1705

An unusual ruby-sapphire transition in megacrystic corundum, New England gem field, New South Wales, eastern Australia

Harris, S.H.[1], Graham, I.T.[1,2], Sutherland, F.L.[2], Coldham, T.[3], Powell, W.[4], Belousova, E.[4]

[1]School of Biological, Earth and Environmental Sciences , University of New South Wales , Sydney, NSW, Australia.
[2]Geoscience, Australian Museum, Sydney, NSW, Australia.
[3] Gemmological Association of Australia, Sydney, NSW, Australia.
[4] ARC National Key Centre for Geochemical Evolution and Metallogeny of Continents (GEMOC), Macquarie University, Sydney, NSW, Australia.

The New England basaltic gem field of Australia is a major producer of megacrystic sapphire from its placers [1]. Ruby is a rare component among the magmatic origin blue, green and yellow sapphires. Rough and faceted stones from the ruby suite were analysed by laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) in this study of their trace element contents. The crystals are zoned from red-pink cores, through bands of white sapphire into violet-purple rims.

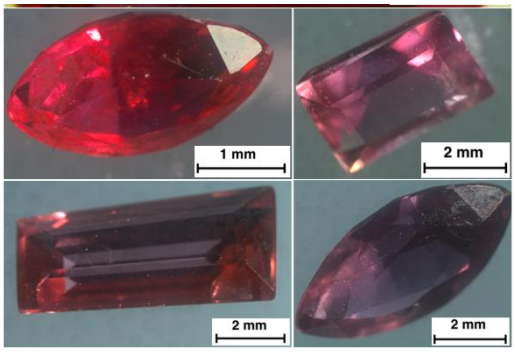
The analyses showed ruby ranged from ~1,000–3,300 ppm in Cr, 2,500–3,500 ppm in Fe, and up to 140 ppm in Mg, 50 ppm in Ti and 290 ppm in Ga. Pink sapphire had lesser Cr (< 1500 ppm) and Fe ranged up to ~5000 ppm. White zones were depleted in Cr (~330 ppm) and Fe (~2,200 ppm) and outer violet-purple zones were relatively low in Cr (<800 ppm). A feature of the ruby is the high Ga contents (>240ppm), much higher than in most ruby.

The trace element transition from red-pink core, white sapphire to violet-purple rim was plotted using a range of variation diagrams constructed by Peucat et al. [2], Sutherland et al. [3], Uher et al. [4] and Giuliani et al. [5] to study corundum source affinities. These suggested transitional affinities between magmatic and metamorphic fields reflecting the high Ga values. This unusual transition is under O isotope study for closer constraints on its genesis. The zoning in the crystallising ruby-sapphire transition indicates Cr-depletion during crystallisation.

A tentative interpretation involves magmatic interaction with a Cr-bearing source underlying the New England Orogen. The presence of Palaeozoic felsic intrusions, fractionated Mesozoic-Cenozoic basaltic rocks and serpentinised ophiolite tectonic emplacements in the sequence provides a potential recipe for magmatic interactions with Cr-bearing ultramafic/mafic lithologies at depth, prior to corundum xenocryst transport in later basalts.

References:

[1] Abduriyim et al. (2012) Aust. Gemmol. 24(10): 234-242
[2] Peucat et al. (2007) Lithos 98(1-4): 261-274
[3] Sutherland et al. (2009) Aust. J. Earth Sci. 56(7): 1003-1022
[4] Uher et al. (2010) Geol. Carpath. 63(1): 71-82
[5] Giuliani et al. (2015) C.R. Geoscience 347: 24-34


1 mm
2 mm
2 mm
2 mm