The Thomson River Cu-Ni-PGE Deposit of the Southeast Lachlan Fold Belt: Implications for Cu-Ni-PGE Prospectivity in Silicic Dominated Magmatic Systems

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World-class Cu-Ni-PGE deposits are hosted by strongly differentiated ultramafic and mafic rocks crystallised in the plumbing systems of large igneous provinces (LIPs). LIPs are of intra-plate origin, comprised predominantly of mafic and ultramafic rocks and characterised by high-volume surface magmatism and extensive subvolcanic intrusive rocks.

The Thomson River Cu-Ni-PGE deposit crops out in the southeast Lachlan Fold Belt in central-east Victoria. Primary ore minerals are chalcopyrite, pyrite and pyrrhotite, with minor pentlandite-cubanite Platinum and palladium are the dominant PGE present and hosted by sperrylite and merenskyite, respectively. The Thomson River deposit is unusual in the respect that it is hosted mafic and ultramafic rocks that represent a relatively minor component of a late Devonian phase of voluminous silicic magmatism. The LIP origin of the Thomson River deposit can, nevertheless, be established via comparison with the Siberian Traps, the host rocks to the Norilsk-Talnakh Cu-Ni-PGE deposits of the Russian arctic. The mafic and ultramafic rocks from both regions: (1) compositionally overlap, (2) were emplaced coeval with crustal extension and terrestrial sedimentation, (3) occur over similar geographic extents and, (4) coincide temporally with major mass extinction events.

Whereas the mafic and ultramafic LIP magmas that formed the Siberian Traps were emplaced into the shallow crust or extruded to the surface, the compositionally equivalent rocks in Victoria mostly stalled at depth and formed an extensive magmatic underplate. The thermal effects of this underplate are reflected in the upper crust via voluminous shallow-level silicic granitoids and the coeval volcanism. The presence of Cu-Ni-PGE mineralisation in both regions highlights that processes in the mantle – in particular the formation of the sulphide undersaturated mantle partial melts - is more important for Cu-Ni-PGE prospectivity that the surface expression of magmatism.