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Continuous country rock contamination and hydrothermal alteration of the Ni-Cu-PGE sulphide-bearing (ultra-)basic Uitkomst Complex, South Africa

Christoph Gauert (1) and Jan Globig (2)

(1) Dept. of Geology, University of the Free State, Bloemfontein, South Africa (Gauertcdk@ufs.ac.za), (2) Group of Dynamics of the Lithosphere, Institute of Earth Sciences Jaume Almera - CSIC, Spain (jan_globig@yahoo.de)

This mineralized ultrabasic to basic igneous complex of Bushveld Complex age (De Waal et al., 2001) and with affinity to a Bushveld complex primary magma composition Gauert, 1998) deserves further investigation, since new drill core material became available. An intersection of the downdip extension of the complex of constant thickness reveals upper gabbronoritic units which are geochemically evolved and strongly contaminated with quartz by assimilation of country rocks.
Hydrothermal, partly deuteric alteration is widespread over the complex, but pronounced in its lower and upper zones. Selective, connate to meteoric fluid ingress, controlled by contact metamorphism (Sarkar et al., 2008) and structure (Joubert, 2013), led to significant deuteric alteration. Highly talc-carbonate altered chromitiferous peridotite sections show formation of cube-shaped spinels, probably indicating auto-metamorphic conditions. Autometamorphism of the ultrabasic rocks produced a wide range of non-sulfide assemblages, despite the relatively restricted compositional range within each rock type; a crucial variable is the XCO_2 of the metamorphic fluid. The sulphide mineralogy of the ultramafic-hosted deposit is influenced by the temperature and composition of the hydrothermal fluid. Reduction reactions associated with the serpentinization fronts in the dunitic adcumulates gave rise to Ni-Fe alloy and native Cu bearing assemblages. Greenschist facies hydration gave rise to serpentinites, hosting assemblages rich in pentlandite and in some cases violarite and marcasite, mackinawite, millerite, and valleriite. Oxidized fluids associated with low temperature talc-carbonate alteration in the chromitiferous peridotite formed Ni-sulphide minerals coexisting with pyrite and hematite. Both the sulfide and nickel components in the ore may contain substantial proportions of the total nickel budget. Low temperature alteration effectively redistributed the sulfide elements in serpentinites, leading to highly variable Cu/(Cu+Ni) ratios. In areas of thorough alteration nickel can almost completely reside in sulphide minerals. The country rock contamination in the marginal zones and the alteration appear to continue along the downdip extension with nearly constant intensity over a distance of at least 9 km towards north-west.

References:
De Waal, S.A., Maier, W., Armstrong, R. and Gauert, C.D.K., 2001. Chemical constraints on the differentiation and emplacement of the Uitkomst Complex, Mpumalanga Province, South Africa, Canadian Mineralogist: 39, 557-571.
Gauert, C.D.K., 1998. The Petrogenesis of the Uitkomst Complex, Mpumalanga Province, South Africa. Unpublished Ph.D. thesis, University of Pretoria, 315p.
Guenther, C., and Gauert, C., 2013 The spatial distribution and geochemical characteristics of the talc-carbonate alteration of the Uitkomst Complex. 12th biennial SGA meeting, Uppsala, Sweden. Proceedings: 3, 993-996.
Joubert, P.L., 2013. Syn- to post-intrusive deformation in the Chromitiferous Harzburgite Unit of the Uitkomst Complex, Nkomati Mine, Mpumalanga Province. Unpublished M.Sc. thesis, University of the Free State, Bloemfontein, South Africa, 155p.
Sarkar, A., Ripley, E.M., Li, C., Maier, W.D., 2008. Stable isotope, fluid inclusion, and mineral chemistry constraints on contamination and hydrothermal alteration in the Uitkomst Complex, South Africa. – Chemical Geology, v. 257: 129-138.