Controls on Voisey Bay –type magmatic Cu-Ni mineralisation: A case history from the Caroline and Harcus Giles Complex intrusions, SA

Thesis submitted in accordance with the requirements of the University of Adelaide for an Honours Degree in Geology

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November 2013

THE UNIVERSITY of ADELAIDE

MAGMATIC CU-NI MINERALISATION: GILES COMPLEX

ABSTRACT

Intrusion related magmatic copper-nickel sulphide ore bodies are of great economic interest but there are a variety of different factors that play a role in their development in the crust. The evolution of magma through the crust has a great impact on the potential for an economic ore body to be formed and as such different intrusions are the subject of study to better understand their evolution in this regard. This study investigates two intrusions, Caroline and Harcus, that are part of the larger *Giles Complex Intrusions*, found in the Musgrave province in far north of South Australia.

Analysis of petrography, mineral chemistry and whole rock chemistry was undertaken including Nd-Sr isotopic analysis. From this it was possible to define that the Caroline intrusion has experienced ~35% crustal assimilation in its evolution and has not experienced a sulphide saturation event before emplacement. The Harcus intrusion has experienced ~15% crustal assimilation in its evolution and has likely already experience a sulphide saturation event in its evolution. It was also possible to define that the Harcus intrusion appeared to be a trapped melt and not a layered intrusion like that of the Caroline intrusion. From the work that was undertaken a model composition for the initial melt from which both intrusions formed was defined. This was tested using crystallisation modelling and was found to be an adequate match to the different compositions of the intrusions. An emplacement model for the two different intrusions has been proposed.

The more ideal economic target has been defined to be that of the Caroline intrusion as it has not experienced a prior episode of sulphide saturation.

KEYWORDS

Controls, Voisey Bay, Magmatic, Nickel, Copper, Sulphides, Musgraves, Caroline, Harcus, Giles Complex, WLIP

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