Potential for Nickel-Copper Sulphide mineralisation in the Giles Complex

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

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November 2012

THE UNIVERSITY of ADELAIDE

TITLE

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RUNNING TITLE

A further study on drill cores taken from the Mt Caroline region

ABSTRACT

The Giles Compex is a series of layered intrusions in central Australia and is part of the Musgrave Block. It has the potential for Nickel-Copper sulphide mineralisation and has been studied many times previously. Samples were taken from a region around the western side of MT Caroline to analyse their potential for these sulphides. The samples from the Woodroffe group all have visible sulphides present and seem to have a higher potential for nickel-copper sulphide mineralisation than the one set of samples taken from the Caroline group as comparison. As such futher study should be undertaken on the samples from the Woodroffe group to fully understand their potential.

KEYWORDS

Ni-Cu Sulphides, Giles Complex,

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INTRODUCTION

The Giles Complex in central Australia is a series of layered mafic and ultra-mafic intrusions, and has the potential to be a source of nickel and copper sulphide mineralisation. A large nickel-copper sulphide deposit has already been found within the Nebo-Babel deposit, located in Western Australia, so it is possible that there are more of these deposits throughout the Musgrave Province, which is where the Giles Complex is located. Several parameters are used to determine whether an area contains large amounts of nickel-copper sulphide mineralisation; these are outlined in Lamberg (2005).

The Musgrave Province, in central Australia, is an earliest Mesoproterozoic to Neoproterozoic belt bound by Neoproterozoic to Palaeozoic basins (Evins *et al.* 2010). The Giles Complex lies within this province, and has attracted attention due to its potential for housing large areas of nickel-copper sulphides. The largest of these areas found so far is the Nebo-Babel deposit within Western Australia. Nebo-Babel is the first significant discovery of nickel sulphide deposit associated with the Giles Complex (Seat *et al.* 2007). Crustal contamination has been proven to be the key process in the formation of the ores in almost all the studied Ni deposits (Lamberg 2005).

There are several parameters used to determine the potential for nickel-copper sulphide mineralisation within an area. The most significant ones deal with the origin and primitiveness of the magmas which formed the complex of mafic intrusions. The more primitve the magmas are, the more likely that there will be some nickel sulphide mineralisation in the complex. This is only one of the parameters which must be fullfilled before it becomes more likely that there actually is some nickel-copper sulphide mineralisation within the area. There are several other parameters and the more that are completed, the more likely it is that this mineralisation will occur. Thes include: the sulphide saturation of the magma, the equilibrium of sulphides with the magma, the accumulation of the sulphides and the mobilisation of these sulphides within the magma. There is also a parameter which deals with the dominant pyroxene (clino- or orthopyroxene) of the intrusion, as those intrusions which are dominated by orthopyroxenes tend to be more favourable towards nickel sulphide ore bodies than those which are dominated by clinopyroxene. The examples in Lamberg (2005) were examined using these parameters.

Drill cores were sampled from the Giles Complex, specifically the region around the western part of Mt Caroline by Pepinnini Minerals Limited. Samples were taken from these drill cores to assess their viability for nickel-copper sulphide mineralisation.

METHODS

Samples were taken from drill cores provided by Pepinnini Minerals Limited. They were selected based on depths which suggested that they may be useful in obtaining nickel-copper sulphides based on previous works done by the company. Samples were also taken based on whether there were visible sulphide minerals present, as this indicated that these areas may have a higher potential for nickel-copper sulphide mineralisation.

OBSERVATIONS

Samples were taken from five different drill cores, all of which were located around the western part of Mt Caroline, within the Giles Complex in central Australia. Four sets of the samples came from the Woodroffe group – drill holes DD10WOD002, DD10WOD003, DD10WOD004 and DD10WOD013 – as these seemed to have the highest potential for having high amounts of nickel-copper sulphide mineralisation. The last set of samples came from the Caroline Group (DD09CAR011) and these were intended to be an outlier group, as the samples did not show many visible sulphide minerals and appeared to be quite a different form of rock when compared to the samples from the Woodroffe Group.

DD10WOD002

Seven sample sets were taken from this drill hole, at depths of 45, 67, 110, 130, 135, 150 and 153 metres. This was the most sample sets taken from a drill hole as this hole showed the greatest potential for nickel-copper sulphide mineralisation from previous works. All of these samples were gabbroic in nature. The grain size of all of these samples is rather coarse, with the samples at 135 and 150 metres having more of a medium grain size. Pyroxenes were the most dominant mineral throughout the samples. The sample taken at 110 metres also contained some feldspar grains. Sulphides were present in all of the samples taken, though they tended to be small in size and not always apparent straight away. All of these samples were very crystalline.

DD10WOD003

Three sample sets were taken at 65, 75 and 85 metres of depth. These samples were also gabbroic in nature. These samples had a smaller grain size when compared to those from DD10WOD002 and were more of a medium-coarse size. These were also rich in pyroxenes and had smaller crystals of sulphide minerals (pyrite and chalcopyrite). These smaller crystals were present throughout the samples. The samples taken at 85 metres of depth appear to show a possible boundary between two different rock types. These samples were also quite crystalline.

DD10WOD004

Three sample sets were also taken from this drill hole, at 190, 215 and 220 metres of depth. The rocks were gabbroic in nature and the grain size between the samples varied from coarse (190 metres depth) to medium (215 metres of depth) with the samples taken at 220 metres of depth showed a medium coarse grain size trend. The samples taken at 190 metres of depth had large sulphide minerals throughout the rock, as well as the presence of pyroxenes. Pyroxenes were also present in the other samples taken from this drill core. At 220 metres of depth there were small sulphide minerals present throughout the rocks. The samples taken at 215 metres of depth also appear to show a boundary between differing rock types.

DD10WOD013

From this drill core three sample sets were taken. These were taken at 100, 104 and 125 metres of depth. These were also gabbroic rocks. The grain size of these rocks was all coarse-medium in size except for those found at 125 metres of depth, which were coarse in size. Pyroxenes were present throughout the rocks in all samples. There were also feldspars present in these samples as well. Sulphide minerals were also present throughout all of the samples. However, in those at 125 metres of depth, the sulphide minerals were quite rare.

DD09CAR011

There were four sample sets taken from this drill core, at 230, 240, 305 and 310 metres of depth. These rocks were also gabbroic in nature. The grain sizes of all of the samples were a coarse-medium size. Again, pyroxenes were present throughout all of the samples. There were very rare sulphide minerals present; their presence was very low compared with the samples from the drill cores of the Woodroffe Group. These rocks were all strongly banded throughout. The sample taken at 305 metres of depth was possibly another boundary between two different rock types.

DISCUSSION

From these observations and the previous work done on these rocks it appears that the sulphide minerals are present in very low abundances if they are at all present in the rocks.

DD10WOD002

These samples appeared to have the highest possibility for the presence of nickel-copper sulphide mineralisation throughout the rocks. There were many visible sulphides present in those rocks as well as high amounts of pyroxenes present also. The feldspars which were present at 110 metres of depth indicate that there has been some crustal contamination of the original magmas that created the intrusion, so this coupled with the visible sulphides and the pyroxenes, possibly gives the area a higher chance of nickel-copper sulphide mineralisation. Therefore this seems to indicate that the area these samples came from may be viable for the mining of nickel-copper sulphides.

DD10WOD003

There was also an abundance of pyroxenes in these samples, however there were little/no feldspars present in these rocks, so there is less evidence of crustal contamination in these rocks. However, there are still some visible sulphide minerals, which indicates that there may be a possibility that there is some nickel-copper sulphide mineralisation present; however this is not as strong a likelihood as in the samples from DD10WOD002. The rock type boundary found in some of the samples may also have something to do with the lower potential of this area.

DD10WOD004

There were abundant sulphide minerals present in these rock samples; however the lack of feldspars also in these samples shows that there has been less crustal contamination in the rocks. This means that the samples from this area may also be less viable for nickel-copper sulphide mineralisation. As there was a rock type boundary found in some of the samples, it may indicate that these depths are not as viable for nickel-copper sulphide mineralisation.

DD10WOD013

These rock samples are very megacrystic and they also contain an abundance of pyroxenes throughout the rocks. There are also large feldspar grains present throughout these samples. These are an indicator that there has been some crustal contamination within these rocks, so that there may be a higher chance of nickel-copper sulphide mineralisation occurring within them. This is further supported by the relatively large amounts of sulphide minerals in the rocks.

DD09CAR013

There was little/no sulphides present through the samples taken from this drill core, which already is an indicator that the area from which the core came from is most likely not a viable area for nickel-copper sulphides. That the rocks appear to have been altered and are strongly banded also works against them. There may be large amounts of feldspars present, indicating crustal contamination, but the original magma may have been less primitive, leading to a lower chance of nickel-copper sulphide mineralisation occurring in these rocks.

CONCLUSIONS

From this study it appears that the samples taken from the drill holes DD10WOD002 and DD10WOD013 may be within the areas that are the most viable for nickel-copper sulphide mineralisation and as such they should be studied in more detail to determine the exact nature of the rocks and their overall viability. All of the samples could be studied in more detail to check their viability as well.

ACKNOWLEDGMENTS

John Foden, Todd Williams, Pepinnini Minerals Limited, Katie Howard

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