Trace Elements in Magnetite and Hematite for Improving Pathfinder Element Selection of the Hillside copper mineralisation, Yorke Peninsula

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1 Abstract

The Hillside deposit is located in the southern part of the Olympic Province onthe Gawler Craton, South Australia. This area has a history of IOCG-U style deposits, including the word class Olympic Dam deposit. Several other deposits and prospects have also been identified within this Olympic Dam domain. The Hillside deposit was discovered in the 1800s but recent work by Rex Minerals has expanded the mineralisation zone and have categorised this deposit as part of the IOCG-U family. A prominent characteristic of the Hillside IOCG mineralisation is the conversion of magnetite to hematite which in previous works on IOCG-U deposits has shown to be related to the mineralisation process. Two main mineralizing episodes can be distinguished, an earlier one was extremely Fe rich and allowed the formation of magnetite and pyrite. The second stage of mineralisation involved the injection of copper mineralizing fluids concurrent with the widespread replacement of magnetite by hematite. Analysis of the iron oxides was carried out using optical methods as well as, trace element and rare earth element analysis by Electron Probe Micro Analysis and Laser Ablation ICP MS. The trace elements were used to identify compositional signature variation between the different iron oxide minerals. The rare earth element analysis showed a distinct overall enrichment in the hematite samples compared to the magnetite. The trace element analysis showed that several elements are distributed differently between the two oxides and sulphides. These elements include Cr, Zn, V, Ti, Ni, Pb and Co which show anomalies in both the oxides and sulphides. A variation between what elements are enriched is depent on the mineral they are found within. This is suggested to reflect changes in composition of the mineralising fluid from the early magnetite-pyrite to the late hematite-chalcopyrite stage. The sulphides showed that chalcopyrite was enriched in several trace elements compared to pyrite,. Sulphur isotope data were derived for pyrite and chalcopyrite also to characterise the source of the fluids. There was no systematic difference between chalcopyrite and pyrite. The data did show negative values between -2.6 $\delta^{34}S$ and -6.6 $\delta^{34}S$ which indicates that the source of the sulphur is most likely magmatic. This study gives an indication into the change in conditions that caused the replacement of magnetite by hematite and therefore the changes that caused mineralisation. An element signature was also collected to indentify the difference between the iron oxides that will help in future works on this deposit.