Electrical structure analysis of Carrapateena and Wirrda Well prospects, Stuart Shelf, from integrated geophysical and drillcore data

J.K.B. Low

Supervisors: K Selway, G S Heinsen

2010 Honours student, Centre for Tectonics, Resources and Exploration

Geology and Geophysics, School of Earth and Environmental Sciences,

The University of Adelaide, Adelaide, S.A 5005, Australia

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ABSTRACT

Magnetotelluric (MT) datasets from Carrapateena and Wirrda Well prospects were inverted to produce MT models with geophysical and drillcore data as constraints. MT is an excellent technique in mapping the distribution of prospective rocks shielded by thick layers of cover sequences. However, the causes for most enhanced conductivity anomalies remain poorly understood and would require further research and investigation. The MT model of Carrapateena detected three conductive anomalies distributed across the southeastern and western side of the survey area. The MT data were able to detect the ore body described by the drillcore logs and potential field surveys but was shown to be imaged at only the first 500-900m of the basement rocks. However, at greater depths, the anomaly deviated to the west of the survey area although the drillcore logs and potential field surveys indicated otherwise. The loss of conductivity is suggested to be due to the change in nature of the sulphides from interconnected sulphides to disseminated sulphides. In addition, both the western and southeastern anomalies imaged at a depth of 1km are hypothesised to be caused by shear zones from a northeast and a northwest trending fault. The MT model of Wirrda Well detected two enhanced electrical anomalies at the north and south of the survey region. The northern and southern anomalies were shown to have high conductivity despite having a low density contrast from the potential fields survey. The lack of drillcore logs within the vicinity of the anomalies prevented further understanding as to the cause of both anomalies. However, observation of a nearby drillcore log at WW02 suggested a low concentration of interconnected sulphides to be the cause of the anomaly. In summary, the results from this study suggested that the nature of the sulphides play an important role in causing enhanced electrical anomalies in an MT model. The results also indicate a possible detection of anomalies caused by mineralisation along shear zones. Therefore, MT may be a poor choice for detection of ore bodies on the Stuart Shelf but could potentially be useful in imaging pathways of mineralising fluids through faults or shear zones. This could be invaluable with further research to understand and investigate the formation of IOCG deposits. The lack of drillcore logs at the identified anomalies within Carrapateena and Wirrda Well however proved to be a limiting factor in achieving a solid conclusion for the proposed hypothesis described above.