3D geological model and structural analysis of the Neoarchean to Paleoproterozoic Hamersley Basin, Pilbara, Western Australia

A. Piechocka[1], M. Jessell[2] and D. Martin[3]

1.Senior Research Scientist, Commonwealth Scientific and Industrial Research Organisation, Kensington Western Australia 6151. Nishka.Piechocka@csiro.au:
2.Professor, University of Western Australia, Crawley Western Australia 6009. Mark.Jessell@uwa.edu.au:
3.Senior Geologist, Geological Survey of Western Australia, East Perth Western Australia 6004. David.Martin@dmirs.wa.gov.au.

Keywords: Hamersley Basin, Pilbara, 3D modelling, structural analysis, iron ore mineralisation

ABSTRACT

The Hamersley Basin of Western Australia, approximately 500km long by 200km wide, is recognised globally for its rich endowment of iron ore resources. Two types of bedded iron ore mineralisation are recognised: the Paleoproterozoic hypogene martite-microplaty hematite ores; and, the more recent Cenozoic supergene martite-goethite ores. Depending on the style of mineralisation targeted the exploration strategy will vary, however, common to both martite-microplaty and martite-goethite ores the host stratigraphy and structure are key exploration indicators. Therefore, the ability to visualise the 3D geology of the entire basin is critical for the understanding of iron ore occurrences and iron ore genesis of bedded iron ore mineralisation. However, due to the large size of the basin generating a 3D geological model representing the regional stratigraphy and structure has not been possible, or prioritised, primarily due to software limitations. Recent advances in implicit automated geological software modelling presents an ideal opportunity to develop a 3D model of the entire Hamersley Basin. The innovative *Loop* software was used to model the stratigraphy and structure of the Hamersley Basin utilising open source geological data (i.e., geological mapping, outcrop orientation data, and fault data) sourced from the Geological Survey of Western Australia. In addition to generating a 3D geological model information such as stratigraphic thickness and fault offset information was extracted using the *map2loop* module and used for further detailed structural analysis. This study demonstrates how a basin wide 3D geological model was used to conduct a regional structural analysis of the Hamersley Basin. The results of this study provide opportunities for other prospective regions to be modelled at a rapid pace and the data used to enhance the understanding of the geology and aid in exploration targeting.

This research is supported by the Minerals Research Institute of Western Australia as project M0557. We also acknowledge the support from the ARC-funded Loop: Enabling Stochastic 3D Geological Modelling consortia (LP170100985) and DECRA (DE190100431). The work has been supported by the Mineral Exploration Cooperative Research Centre whose activities are funded by the Australian Government's Cooperative Research Centre Programme. This is MinEx CRC Document 2021/XXX. Source data provided by GSWA and Geoscience Australia.