



New insights into ancient ice sheets: the Luoquan Glaciation (Ediacaran-Cambrian) of North China

Daniel Le Heron (1), Guanghui Wu (2), Thomas Vandyk (3), and Li Meng (4)

(1) Department of Geodynamics and Sedimentology, University of Vienna, Althanstrasse 14, A-1090 Vienna, Austria. (daniel.le-heron@univie.ac.at), (2) Key Laboratory of Offshore Oil Exploration and Development of Guangdong Higher Education Institutes, Sun Yat-sen University, Guangzhou 510006, China., (3) Department of Earth Sciences, University College London, Gower Street, London, WC1E 6BT, UK., (4) Key Laboratory of Offshore Oil Exploration and Development of Guangdong Higher Education Institutes, Sun Yat-sen University, Guangzhou 510006, China.

The Luoquan Formation represents the record of Ediacaran-Cambrian glaciation in the North China Craton. The sedimentary record is well expressed in the Henan Province along the central China orogen, and includes a rich archive of striated pavements, diamictites, and dropstone-bearing laminites. Reappraising the sedimentological evolution of the Luoquan Formation we note the following. First, striated pavements with crosscutting striations do not necessarily record multiple phases of glacial (re)advance, but more likely originate through the development of sticky spots in a palaeo-ice stream setting. The development of obstacles, basal adfreezing, or porosity variations in the subglacial substrate resulted in curvilinear and bifurcating striae, which can superficially be mistaken for crosscutting striae in isolated sections. Second, “massive” diamictites as previously described are in fact commonly weakly stratified, and there is a continuum from dropstone-bearing rhythmically bedded shales and siltstones, through stratified diamictites to massive diamictites. This continuum is interpreted to indicate that those diamictites with less pronounced stratification were also deposited by rain out from debris rich ice, in contrast to a mass flow hypothesis that has been suggested previously. Thirdly, we reveal the presence of large-scale, recumbent folds with associated thrusts at the type section. The suite of large-scale deformation structures- measuring >30 m in amplitude- is sealed by undeformed diamictites. The deformation structures are interpreted to reflect soft-sediment deformation structures produced through ice bulldozing. Integrating these observations, we propose deposition of the Luoquan Formation in a large paraglacial lake setting, with a range of ice contact to ice distal environments recognised.