Towards a better understanding of the Mezoproterozoic Irumide Belt of Zambia: Report on a geotraverse across the belt

Report on the third annual field meeting of IGCP 418 — The Kibaran of Southwestern Africa

Introduction

The third field meeting of IGCP 418 (The Kibaran of Southwestern Africa) was held jointly with IGCP 419 (Foreland basins of Neoproterozoic belts between Africa and South America) in Kitwe, Zambia during July 1999. The event was organised by the Geological Society of Zambia with help from the Geology Department of the University of Zambia and the Geological Survey Department. A six-day pre-conference field trip took a total of 27 participants across the Irumide belt and its southernmost intersection with the Neoproterozoic Zambezi and Mozambique belts. The field trip was followed by a three-day conference in Kitwe, which attracted a total of 65 professionals, 28 of which presented papers on various topics related to IGCP 418 or 419. A total of 19 presentations, directly related to IGCP 418, were presented in four sessions and were followed by a business meeting. An abstracts volume was published, which contains abstracts of all presented papers for the two meetings.

Background

The principal purposes of IGCP 418 can be summarised as follows:

- to exactly define the present geographical distribution of Mesoproterozoic rocks and structures in southwestern Africa in order to incorporate this information into a global synthesis of Mesoproterozoic belts related to the formation of Rodinia. As part of this exercise it is also necessary to define areas where Mesoproterozoic terranes have been overprinted by younger orogenic belts. In particular, for southwestern Africa, the effects of the late Meso- to Neoproterozoic Damaran orogeny on concealing and destroying the full extent of Mesoproterozoic belts have to be understood.
- to construct cross-sections across the various Mesoproterozoic belts of southwestern Africa.
- to compile a chronological sequence of geological events within each Mesoproterozoic belt.
- to provide reliable absolute time constraints for the major geological events within each belt.
- to identify the Mesoproterozoic events occurring outside of the main belts in their cratonic forelands in order to better understand the geological setting of the Mesoproterozoic belts.
- to elucidate the original geotectonic setting of the Mesoproterozoic belts of southwestern Africa.
- to evaluate the mineral potential of the Mesoproterozoic terranes.

Amalgamation of the Rodinia Supercontinent, a precursor to all the later supercontinents, is the major geodynamic event during the Mesoproterozoic era. Parts of Rodinia survived until the Mesozoic fragmentation of Pangea; other parts broke up in the Neoproterozoic. The record of amalgamation and breakup of Rodinia is preserved in Mesoproterozoic mobile belts and Neoproterozoic basins at the margins of most Paleoproterozoic cratons. In order to produce a well-constrained reconstruction of the global distribution of continental crust at the end of the Mesoproterozoic, it is important that the geological evolution of the Mesoproterozoic orogenic belts (or Plate Boundary Zones) is properly understood.

The southwestern parts of the Kibaran belt and the contemporaneous Irumide belt of Central Africa are concealed by younger rocks and sediments. However, new regional detailed geophysical surveys, notably in Botswana and Namibia, are enabling us to delineate the full extent of these, and other Mesoproterozoic terranes in southwestern and Central Africa. New geological mapping, in conjunction with geochronological and other laboratory work on the Mesoproterozoic terranes allows for a fuller understanding of their evolution. The main aim of the 1998 field meeting was to gain a better understanding of the Mesoproterozoic geology of the NW Botswana Rift (Key and Mapeo, 1999). This feature can be traced right across northwestern Botswana and provides a possible link between the intracratonic Kibaran and Irumide belts of Central Africa to the Namaqua belt of southwestern Africa, within the global chain of Mesoproterozoic tectonic belts. Late Mesoproterozoic rocks within the NW Botswana Rift include the bimodal volcanics of the Kgwebe Formation dated at 1106+2 Ma (Schwartz et al., 1996).

This year's field meeting was aimed at attaining a better understanding of the well-exposed Irumide belt in Zambia. The field trip allowed the participants to map cross-sections through critical areas of the Irumide belt.

The Irumide belt

The Mesoproterozoic geological history of Zambia is preserved in several geological terrains, the most significant being the Irumide belt and the Choma-Kalomo block. The Irumide belt (Ackermann, 1950; Ackermann and Forster, 1960) is a 1,000 km long, NE–SW trending region of crystalline metamorphic and metasedimentary rocks, covering the eastern part of Zambia. The northern and northwestern foreland of the Irumide belt consists of Palaeoproterozoic granite gneisses of the Bangweulu block. The eastern, southern and western boundaries of the Irumide belt are uncertain due to both the presence of a cover of Neoproterozoic sedimentary rocks and strong overprinting of Mesoproterozoic rocks by Neoproterozoic tectonothermal events (Lufilian, Zambezi and Mozambique belts).

Previous sedimentological and structural studies of the Irumide belt have concluded that the belt has gone through an orogenic cycle involving rifting, sedimentation and collision (Daly et al., 1984). On structural grounds, the Irumide belt is divisible into three regions: northern, central and southern.

The Northern Irumide belt

The northern part of the Irumide belt consists of continental and shallow marine sedimentary rocks comprising conglomerates, sandstones and pelites which were deposited in structurally controlled basins (Fitches, 1971; Daly and Unrug, 1982). On the Bangweulu block foreland, fluviatile and lacustrine sediments of the Kasama Formation form a thin (ca.350 m) sheet, which thickens progressively to 10,000 m towards the basin interior (Ackermann and Forster, 1960; Fitches, 1971; Daly and Unrug, 1982). Sedimentation was accompanied by localised bimodal volcanism represented by thin felsic tuff beds and basalt flows interbedded within the pelitic units (Daly, 1986a; Mosley, in press) from which it can be presumed that the development of the Irumide basin was rift related. Deformation and metamorphism in the northern Irumide belt is typical of foreland fold-thrust belts, characterized by thin-skinned tectonics with basement cover decoupling and high level thrust verging towards the basement foreland (Daly, 1986), and low metamorphic grades (Fitches, 1971) (Figures 1, 2).