



Project 5.1 Global tectonic database and palaeogeographic map production

Project Co-ordinator: Sergei Pisarevsky

Aims:

This program involves two streams of work. The first is the development of sets of rotation parameters for reconstructing the palaeogeographic history of the Earth. This work will rely on systematic analysis of available palaeomagnetic data (using the Global Palaeomagnetic Database administered at the TSRC), and geological constraints are provided by Programs 1-3 and international research programs such as IGCP 440.

The second work stream entails the production of palaeogeographic and tectonic maps, and includes geological syntheses and visualization.

Progress:

Contributions from Program 1 (TSRC Publ. #156) resulted in a new set of Palaeozoic reconstructions and determined corresponding sets of rotation parameters for Gondwana, Laurentia, Baltica, Siberia, and Kazakhstan. Four alternative sets of rotation parameters for global reconstructions between 800 and 490 Ma based on data from TSRC Publ. #190, with a new manuscript submitted for publication.

New palaeomagnetic data from the Albany-Fraser orogen and Fraser dyke swarm (TSRC Publ. #234, contribution from program 2.1) led to the rejection of any reconstructions with pre-Rodinian Australia-Laurentia connections (SWEAT, AUSWUS, AUSMEX) at 1.2 Ga. This conclusion has important implications for Mesoproterozoic tectonic models.

The rotation parameters for late Meso- and Neoproterozoic global reconstructions (TSRC Publ. #180) have been updated, in particular, a new Siberia-Laurentia fit in Rodinia was proposed (TSRC Publ. #205, contribution from program 2.3, see also Research Highlights and Outcomes). Based on new geochronological, geological and palaeomagnetic data a new model has been proposed for the opening of Iapetus (contribution from program 2.2) and a new global reconstruction for the latest Vendian – Early Cambrian. The publication is in preparation.

The wide variety of previously published Precambrian reconstructions has been due to the poor knowledge of latest Precambrian and Cambrian geological history. The present data do not permit any thorough step-by-step backward restoration of the configuration and breakup of Rodinia from the better known Gondwana and Laurussia reconstructions.

A set of preliminary sketch reconstructions for 12 time slices between 2.45 and 1.0 Ga were published in collaboration with an international group of co-authors in the special volume of Tectonophysics (TSRC Publ. #225, contribution from program 3.2) in honour of Professor Chris Powell. Using these reconstructions as a first approximation, a set of rotation parameters for pre-Rodinian crustal blocks in Palaeo- and Mesoproterozoic is being created.

Two updates of the Global Palaeomagnetic Database (GPMDB) were carried out. The database now contains over 9000 entries. A new Visual Palaeomagnetic Database based on GIS (ArcView) was designed and presented at the 2002 AGU Fall meeting in San Francisco, the EGS-AGU-EUG 2003 Joint Assembly in Nice, France, and published in TSRC Publ. #217. The GPMDB will be placed on the TSRC web-site. Further development of palaeomagnetic databases during 2004-2005 will form part of a joint project “Development and maintenance of the Magnetic Information Consortium (MagIC)” sponsored by the Scripps Institution of Oceanography (San Diego, USA), University of Minnesota (USA), and the TSRC, and supported by NSF grant EAR-0318672.

New software development resulted in a new technique for testing of global reconstructions with geophysical (aeromagnetic and gravity) data. This work has been done in collaboration with Dr Carol Finn (USGS) and Mr Steve Gardoll (Centre for Global Metallogeny, UWA). Aeromagnetic and gravity grids were superimposed on different reconstructions of Rodinia, Gondwana, and Pangea. The results of testing the SWEAT, AUSWUS, and AUSMEX hypotheses and one of the Laurentia-Siberia fits were presented at the 2003 GSA Annual Meeting and the AGU Fall Meeting. A joint paper describing these results is in preparation.



Preliminary Precambrian palaeotectonic maps of Australia, Antarctica, Siberia, Laurentia, South American blocks, North and South China, and Tarim were prepared and are now being reviewed by participants of IGCP 440.

Outcomes: TSRC Pubs. #76, 140, 142, 150, 156, 166, 168, 169, 180, 190, 192, 205, 217, 225, 234 and one paper in review. Four presentations at International conferences in 2003.

Aims for 2004:

- Determination of a preliminary set of rotation parameters for the global reconstructions since 2.5 Ga
- Collation of a full collection of digital geological/tectonic maps at a scale of 1:5 000 000 covering the whole globe
- Completion of the Rodinian 1:10 000 000 tectonic map (through IGCP 440)
- Continued development of the global palaeomagnetic databases in their visual forms
- Unification of the legend for the TSRC final map products and a preliminary set of digital maps using this legend
- Further development of the TSRC web-site, including emplacement of the Global Palaeomagnetic Database and plate reconstructions.

Participants: Z.X. Li, M.T.D. Wingate, Mr B. De Waele, compilers of the Rodinia map (IGCP 440) along with participants of other relevant IGCP projects.

Project 5.2: Rodinia Assembly and Dispersal Maps (incorporating IGCP 440: Rodinia Assembly and Breakup)

Project Co-ordinator: Z.X. Li

Aims:

Over 300 scientists from more than 40 countries participate in this international geological correlation project. It aims to:

1. Determine the configuration of Rodinia and the sequence of events in the amalgamation process;
2. Determine whether the Palaeoproterozoic cratons originated by breakup of an older, pre-Rodinia

supercontinent, or were independent fragments of continental crust;

3. Improve and enhance understanding of the breakup of Rodinia during the Neoproterozoic;
4. Allow analysis and interpretation of the distribution of Mesoproterozoic and Neoproterozoic mineral resources in a geodynamic framework.

The project will produce a set of GIS-based Rodinia geodynamic maps illustrating the formation and breakup of the supercontinent Rodinia. This will help the TSRC to achieve its aims as defined in Program 5.

Progress:

2003 was the final funded year for IGCP 440, and was probably also its busiest year. It organised and was involved in five successful international events, and many new results and ideas have been published through the year. Major events include:

International Symposium and Field Workshop on “The Role of Sri Lanka in Rodinia and Gondwana Assembly and Break-up and the LEGENDS Proposal for a N-S Seismic Traverse Across Southern India and Sri Lanka” (Kandy, Sri Lanka, 29 March to 3 April 2003). The event was organised by Dr Wilbert Kehelpannala at the Institute of Fundamental Studies (IFS), Kandy, Sri Lanka. It was sponsored by the IFS, UNESCO-IUGS-IGCP 440 and the LEGENDS Program. About 20 scientists from Australia, China, Germany, India, Japan and Sri Lanka, participated in the event. Dr Alan Collins from TSRC presented a paper at the indoor meeting and participated in the field trip, which examined Palaeoproterozoic and Grenville-age rocks, and Pan-African structures in Sri Lanka.

Field workshop on “Magmatism at the passive margins of Rodinia” (Ufa, Southern Urals, Russia, 22 July to 3 August 2003). The workshop was organized by Dr Viktor Puchkov of the Institute of Geology, Ufimian Scientific Centre of the Russian Academy of Sciences. A one-day technical session in Ufa was followed by a 10-day field trip in the Southern Urals (the Bashkirian anticlinorium). Sixty scientists attended the technical session. The field excursion was designed to allow participants to collect representative samples for isotope,