United Nations
Educational, Scientific and
Cultural Organization

Project Proposal Form 2014

IMPORTANT: Please fill in the form, following closely the instructions, taking into account the IGCP guidelines, which are on the IGCP website. For information on the necessary content of an application (e.g., allowable funding), refer to the detailed IGCP guidelines.

Print a copy, sign it, and send it to:

IGCP Secretariat
Margarete Patzak
Division of Ecological and Earth Sciences
UNESCO
1 rue Miollis
75732 Paris Cedex 15
France

ANOTHER COPY SHOULD BE SENT AS AN ATTACHMENT VIA E-MAIL TO:
m.patzak@unesco.org or ml.faber@unesco.org

Proposals must reach Paris by October 15th in order to be considered for funding for the following year.

1. Indicate the topic(s) into which the project falls

For the Annually defined topics -if any- refer to the annual 'Call for IGCP Project Proposals'.

(i) *Topics of particular interest to IGCP*

1.1 Earth Resources	☒
1.2 Global Change	☐
1.3 Geohazards	☐
1.4 Hydrogeology	☐
1.5 Geodynamic	☒

(ii) *Annually defined topics* ☐

(iii) *Other relevant topics in basic/applied geoscience* ☐

If this is a Young Scientist Project proposal please tick here ☐

2. Short title of the project

The short title of the project should be as brief as possible but still identify its main objective.

Supercontinent Cycles and Global Geodynamics

3. Full title of the project

The full title should be limited to a maximum of around ***fifteen words.***

Supercontinent Cycles and Global Geodynamics

4. Description of the project in layman's terms

Provide a maximum ***200 words-long****, self-contained summary of the project, including its societal benefits. It should be written in plain English / layman's terms and for the non-specialist using a minimum of terminology unique to the area of study. This text will be used to describe your project on the UNESCO website.*

Rapid recent progress in supercontinent research indicates that Earth's history has been dominated by cycles of supercontinent assembly and breakup. New developments in geophysical imaging power and computer simulation have provided increasingly clearer views of the Earth's interior, and how the moving plates on the Earth's surface interact with the deep planetary interior. In this project, we will bring together a diverse range of geoscience expertise to harness these breakthroughs in order to explore the occurrence and evolution history of supercontinents through time, and the underlying geodynamic processes. As part of this project, we will establish/improve global databases of geotectonics, palaeomagnetism, mineral deposits, and the occurrences of past mantle plume events, and examine how the supercontinent cycles interacted with the deep mantle to produce episodic and unevenly distributed Earth resources. The project builds on the success of a series of previous IGCP projects. It will not only lead to major scientific breakthroughs, but also develop user-friendly GIS-based databases that can be used by anyone who wants to reconstruct palaeogeography, test geodynamic models, model major climatic events such as Snowball Earth events, and predict exploration targets for Earth resources.

5. PROPOSED BY

Academic titles and names of the proposer(s) should be inserted. Provide also full mailing address(es), telephone, fax numbers, and e-mail address(es). The first listed name will be the focal point for future correspondence. UNESCO and IUGS encourage you to respect gender equality issues in all new IGCP projects.

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6. SCALE OF THE PROJECT

The scale of the project must be indicated among the choice given.

- sub-continental/regional ☐
- continental ☐
- inter-continental ☒

7. ESTIMATED DURATION OF THE PROJECT

Maximum life-time of an IGCP project can be five years.

- 3 years ☐
- 4 years ☐

- 5 years ☒

8. Full description of the project (sections 8.1 through 8.10)

8.1 Aims and background

Describe the aims and rationale of the proposal. Include information on work already undertaken by the proposers that is relevant to the proposal. ***Maximum length: 2,000 words****, including bibliography.*

Aims

In this project, will assemble teams of multidisciplinary researchers from all around the world to:

1. Improve our understanding of the existence, configuration and evolution history of pre-Pangaea supercontinents and the possible cyclic nature of supercontinent evolution. We will address the Neoproterozoic supercontinent Rodinia, the configuration of which is still controversial, and the much less known older (Palaeo(?)- to Mesoproterozoic) supercontinent Nuna/Columbia.
2. Establish or improve GIS-based databases, globally consistent in scale, content and style, that will be used for testing the supercontinental and global geodynamic models. These will be user-friendly, and GPlates*-compatible. They will be made freely available to researchers for non-commercial use. Some of these databases already exist but need to be refined and updated. Content will include basic geology (including large igneous provinces, or LIPs), tectonic interpretations, palaeomagnetism, and mineral deposits.
3. Model global-scale geodynamics to test/refine relationships between plate tectonics/ supercontinent cycles and mantle dynamics.

* *GPlates is a desktop software package for interactive visualization of plate-tectonic (paleogeographic) reconstructions, developed by a Sydney-based international consortium, and is freely available for anyone.*

Background

The plate tectonic theory enables us to see the Earth as a dynamic planet, with tectonic plates colliding to form mountain belts and breaking apart to create new oceans. It was a theoretical revolution in that it broke away from the century-old beliefs that the Earth's tectonic movements were dominantly vertical ones with little or no lateral movement (i.e., the so-called fixist theory). However, the theory has a major shortfall in that there is no satisfactory explanation for the driving mechanism(s) of plate tectonic movements: ridge push, slab pull, slab suction, and/or mantle convection (Becker et al., 1999; Conrad and Lithgow-Bertelloni, 2004; Davies, 1999; Forsyth and Uyeda, 1975; Hager and Oconnell, 1981; Ricard et al., 1993; Zhong and Gurnis, 1995). The recognition of mantle plumes, hot rocks risen from the Earth's deep mantle (Campbell and Kerr, 2007; Morgan, 1971), complicates the debate even further. Although some researchers argued for an active and driving role of plumes in plate dynamics (Morgan, 1971; Storey, 1995), most researchers consider plumes as a factor independent of plate dynamics (Campbell and Kerr, 2007; Davaille, 1999; Hill et al., 1992; Jellinek and Manga, 2004; Phillips and Bunge, 2007). This lack of a clear understanding on how the Earth engine works hinders our ability to achieve a clearer understanding of the evolution of the continents that we live on, or to locate more Earth resources.

However, advances over the last two decades in global tectonics and geodynamics brought us to the dawn of yet another geotectonic revolution, thus the reasons for this new IGCP proposal. Amongst them, three elements stand out:

1) New high-resolution seismic tomography allows us to "see" the internal structure of the Earth's entire mantle. It has shown us that subducted oceanic plates can descend down to over 2800 km, all the way to the core–mantle boundary (van der Hilst et al., 1997), thus supporting the occurrence of whole-mantle convection (Davies, 1999); that the lower mantle of the present Earth is dominated by two antipodal seismic low velocity zones, commonly known as the African and Pacific superplumes, surrounded by high-velocity, subducted cold slabs (Dziewonski, 1984; Romanowicz, 2008); and that at least some mantle plumes are of lower-mantle origin (Courtillot et al., 2003; Montelli et al., 2004; Nolet et al., 2007).

2) Rapidly expanding high-precision Precambrian palaeomagnetic and geological information has allowed us to advance our understanding of supercontinent history and global palaeography from just the last 540 million years (Ma) of the Earth's ~4,500 Ma lifespan to ~1,000 Ma (Dalziel, 1991; Hoffman, 1991; Li et al., 2008; Moores, 1991; Pisarevsky et al., 2003; Torsvik, 2003; Weil et al., 1998) and beyond (Evans and Mitchell, 2011; Hou et al., 2008; Pisarevsky et al.; Zhang et al., 2012; Zhao et al., 2004) (Figure 1). At the same time, an increasing number of studies have documented possible occurrences of Precambrian true polar wander (TPW) events — rotation of the entire mantle and lithosphere relative to the planetary rotation axis (Evans, 2003; Li et al., 2004; Maloof et al., 2006; Mitchell et al., 2011).

3) Rapidly increasing computing power and the development of sophisticated modelling codes are enabling researchers to model 3D–4D geodynamic processes at global to regional scales, with consequent testing and refining of possible interactions between plate tectonic and deep mantle processes (Gurnis, 1988; McNamara and Zhong, 2005; Phillips and Bunge, 2007; Tackley, 2000; Zhong et al., 2007). To take one example, recent work suggests that tectonic plates could apply important controls on the dynamics of mantle plumes including their origin, location, and evolution (Gonnermann et al., 2004; Lenardic and Kaula, 1994; Molnar and Stock, 1987; Steinberger and O'Connell, 1998; Tan, 2002; Zhong et al., 2000).

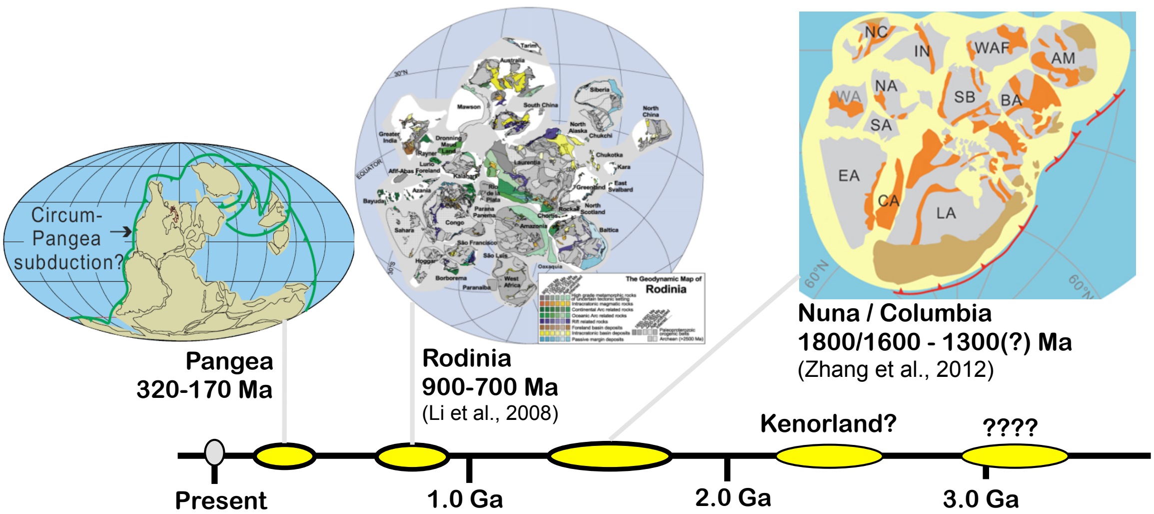

Figure 1. Three of the known supercontinents, with configuration and evolution history becoming increasingly less known (and thus controversial) with older geological time.

These advances are allowing researchers to link present-day plate tectonics on Earth's surface to dynamic processes as imaged by geophysics deep in the mantle (e.g., Müller et al., 2008), and to link the present-day Earth processes to ancient records of geology (e.g., supercontinent cycles, and orogenic, magmatic and sedimentary depositional events), to palaeomagnetic record of continental drift and TPW events, and to deep mantle processes (e.g. plume or superplume events). Together, these allow us to establish and refine new global geodynamic models (Figure 2). Such new understandings have fundamental implications for all aspects of earth science, including the formation and evolution of the continental crust that we live on (Condie, 1998), formation and distribution of Earth resources (Barley and Groves, 1992; Griffin et al., 2013), oxygenation of our atmosphere(Campbell and Allen, 2008), major climate changes (Hoffman, 1999), and life evolution (Santosh, 2010).

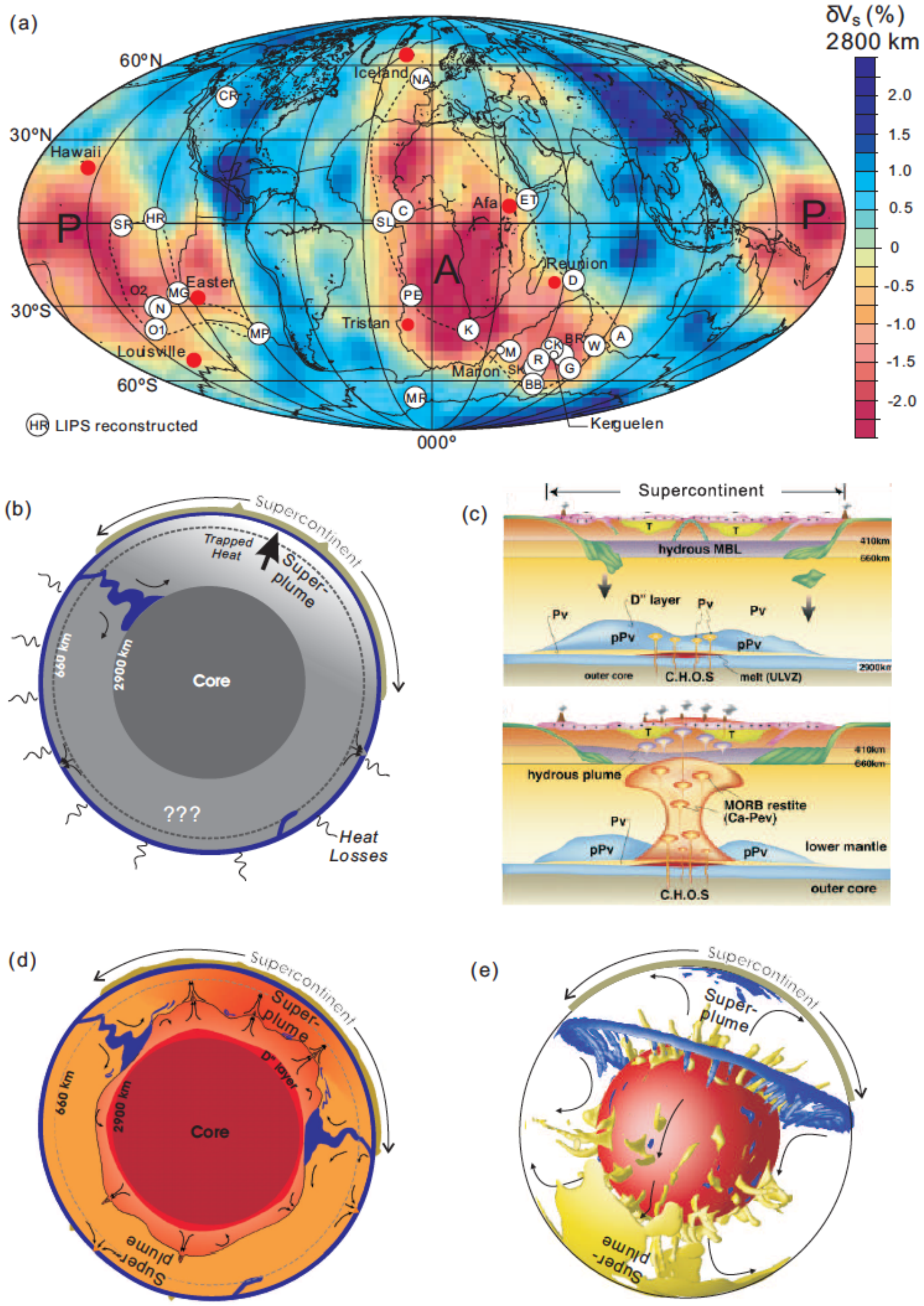

Figure 2 (a) SMEAN shear wave velocity anomalies near the core-mantle boundary (Becker and Boschi, 2002), illustrating the location and lateral extent of the present African (A) and Pacific (P) Large Low Shear Velocity Provinces (LLSVPs), also known as superplumes. Figures (b) – (e) are cartoons showing representative mechanisms proposed for the formation of mantle superplumes, with (b) being the thermal insulation model (e.g., (Anderson, 1982; Coltice et al., 2007; Evans, 2003; Gurnis, 1988; Zhong and Gurnis, 1993), (c) the supercontinent slab graveyard-turned "fuel" model (e.g., Maruyama et al., 2007), (d) the circum-supercontinent slab avalanche model (Li et al., 2008; Li et al., 2004; Maruyama, 1994), and (e) degree-2 planform mantle convection model with sub-supercontinent return flow in response to circum-supercontinent subduction (Zhong et al., 2007). *(from Li and Zhong, 2009)*

8.2 Significance
Describe why the project is significant (scientific advancement, international cooperation, knowledge transfer, technological advancement, etc.) and why support through IGCP funding is crucial to its success. ***Maximum length: 1,500 words****.*

To progress further from here, we will need to develop globally concerted efforts to test the many alternative models for the assembly, configuration, and breakup of the Precambrian supercontinents Rodinia and Nuna/Columbia (e.g., recent IGCP projects #440, Assembly and Breakup of Rodinia; and #509, Palaeoproterozoic Supercontinents and Global Evolution) and that of Phanerozoic Pangaea (#597, Amalgamation and Breakup of Pangaea; and #628, The Gondwana Map Project). We will also need to apply more geological and geophysical constraints to geodynamic modelling in order to build and refine global-scale geodynamic models that are compatible to the supercontinent record and other geological and geophysical records of the Earth's history.

The proposed project is significant both scientifically and socially.

Significantly, this will likely be **the first IGCP project that brings together two heretofore independent research groupings — the large supercontinent community (predominantly geologists and palaeomagnetists) and the emerging deep-time geodynamic community (predominantly geophysicists).** We believe that we need their joint, close cooperation to tackle the most fundamental geodynamic questions that are relevant to almost the entire Earth history and to all aspects of geosciences. This project differs from previous supercontinent-related IGCP projects (e.g., #440 – Rodinia; 509 – Nuna; 597 – Pangaea; 628 – Gondwana) in that it does not focus on a particular supercontinent; rather, it builds on knowledge accumulated during the previous IGCP projects to establish the first-order pattern of supercontinent cycles through Earth's history, and at the same time examines the geodynamic processes that controlled such a pattern as well as the uneven distribution of Earth resources. Outcomes of this project will have fundamental and durable impacts on how people view the evolving Earth system, how the Earth's core, its mantle, its crust, and even its hydrosphere/biosphere/atmosphere interact to each other, and how this interactive dynamic system has produced the rich yet unevenly distributed (both in time and space) Earth resources.

The project will be led by a group of devoted and active researchers with a wealth of IGCP experience. It will involve participation by hundreds of scientists from dozens of countries, including many from less-developed countries and young researchers and graduate students. It will be supported by many of the world's leading laboratories in palaeomagnetism, geochronology, geochemistry, mineral studies, geodynamics, and information centres (see **8.8**). The project will thus provide a truly international collaborative environment for scientists at all stages of their careers and with diverse ranges of cultural backgrounds to undertake research that addresses some of the most "big picture", exciting and important geoscience questions. We will particularly target researchers and students from less-developed countries, particularly African and South American countries. This will be achieved through preferential funding support for researchers (including student) from such countries to participate in project activities, through establish collaborative research links with them, and through organising project activities in those countries such a session at the 2016 IGC in Cape Town (key members have already proposed a relevant session at the IGC), and potential field symposia in those regions (see **8.7** for list of potential locations of joint field activities). As a consequence, not only will the project significantly enhance the standard of geoscience research in developing countries and worldwide, it will nurture a young generation of geoscientists and produce long-lasting international collaborative relationships.

Knowledge transfer will occur at a number of levels/ways. There will be cross-disciplinary knowledge transfers between the field-based (e.g., structural geology, basin analysis), laboratory-based (e.g., palaeomagnetism, geochemistry, and geochronology) and the geodynamic modelling communities. There will be knowledge transfers between researchers from developed countries and those from developing countries. The new knowledge gained from this project (e.g., a refined global geotectonic history and new geodynamic understanding), the enhancement of multidisciplinary databases started by three previous IGCP projects (#440, #509 and #628), the new global palaeogeographic reconstructions from ca. 2000 Ma to the present, and tools developed to link the databases to plate reconstruction software (e.g. GPlates, PaleoGIS), will be used by researchers from many disciplines of geosciences (e.g., palaeoclimatic modelling, life evolution), by the resource industry, and by educational institutions. This will be achieved through scientific publications, conference presentations, contributions to textbooks, web site posting, and news reporting. The project will therefore lead to a knowledge transfer from the project participants to the broader geoscience community and society at large.

The main technological advancement will be enhanced tools (e.g., interactive and user-friendly databases and plate reconstruction software) for visually analysing/presenting plate reconstructions and global mineral systems, or for testing various geotectonic or other ideas/models.

The global scope of this project requires the participation of scientists from all continents. Together with its extremely multidisciplinary nature, it makes IGCP an ideal platform for its undertaking. The annual financial support from IGCP will enable us to facilitate participation by researchers from developing countries as well as students. It will also help us to organise one or two research workshops to brainstorm scientific ideas and establish key collaborative ties at the beginning of the project, or to jointly interpret the final results toward the completion of the project (similar to the production of the Geodynamic Map of Rodinia by the successful IGCP 440).

8.3. Present state of activities in the field of the proposed project
Describe the present state of activities in the field of the proposed project. Include the names of relevant institutions and persons in charge. This should be precisely stated since it reflects the proposer's awareness of the general state of the proposed research field. ***Maximum length: 2,000 words.***

This project involves combining the fields of supercontinent reconstruction and geodynamics. In the field of supercontinent reconstruction, there is a large global community working toward understanding supercontinents Pangaea (ca. 320–170 Ma), Rodinia (ca. 900–700 Ma), and Nuna/Columbia (poorly constrained, but somewhere between ca. 1800 Ma and ca. 1300 Ma) (Fig. 1). The Pangaean supercontinent is the best known and has been studied for about a century. The existence of the late Precambrian supercontinent Rodinia only became widely recognised in the 1990s (Dalziel, 1991; Hoffman, 1991; Moores, 1991), and its precise configuration and evolution are still hotly debated. Our knowledge about the pre-Rodinia supercontinent, variably called Nuna or Columbia (Evans, 2013; Hoffman, 1997; Meert, 2012; Rogers and Santosh, 2002; Zhao et al., 2004), is still in its early days and considerable effort by the supercontinent community is required to reach a consensus reconstruction. There have been speculations about pre-Nuna supercontinents, but the dominant current view is that Nuna was likely Earth's first supercontinent, and before Nuna there were only supercratons (Bleeker, 2003; Evans, 2013; Rogers, 1996).

There are many world-class research groups working on supercontinent reconstructions, spreading across the sub-fields of **palaeomagnetism** (e.g., T. Torsvik et al. of the University of Oslo — Rodinia and Pangaea; J. Meert et al. of University of Florida, Shihong Zhang of China University of Geosciences, M. De Kock of University of Johannesburg, L. Pesonen of University of Helsinki, R. Trindade/M. D'Agrella-Filho of University São Paulo, D. Evans of Yale University, and Z. Li/S. Pisarevsky/E. Tohver of the Curtin-UWA joint facility — Nuna and Rodinia), **geology** (e.g., S. Bogdanova of Lund University, D.

Gladkochub of Russian Academy of Sciences, J. Goodge of University of Minnesota — Rodinia; D. Nance of Ohio University and B. Murphy of St. Francis Xavier University — Pangaea and supercontinent cycles; G. Zhao of HK University and M. Santosh of China University of Geosciences — Columbia/Nuna; P. Betts of Monash University and A. Johanson of Swedish Museum of Natural History — Nuna; A. Collins of Adelaide University — Rodinia and Gondwanaland; K. Condie of New Mexico Institute of Mining and Technology — supercontinent cycles and crustal evolution; M. Brown of University of Maryland — tectonic and metamorphic processes relate to supercontinent cycle), **global distribution of mineral deposits** (e.g., S. Pehrsson of Geological Survey of Canada, R. Goldfarb of USGS, D. Huston of Geoscience Australia), and global **database compilation**, **GIS spatial analysis, and applying machine learning to palaeogeographic reconstructions** (e.g., B. Eglington of University of Saskatchewan, R. Ernst of ErnstGeosciences, S. Reddy of Curtin University, D. Bradley of USGS, and D. Muller's group at Sydney University).

The field of geodynamics started to become fused with the supercontinent research community in the past few years. Topics of current research include how tectonic plates, particularly subducting plates, interact with mantle dynamics; the lifespan of the two antipodal large low-shearwave-velocity provinces (LLSVPs) found in present-day lower mantle; and if the formation and evolution of the LLSVPs are coupled with the supercontinent cycles. Lead research groups in this field include that of B. Steinberger of GFZ German Research Centre, L. Moresi of Melbourne University, S. Zhong of University of Colorado, P. Tackley of ETH Zürich, M. Gurnis of Caltech, N. Coltice of Université Claude Bernard Lyon 1, B. Phillips of Los Alamos National Laboratory, M. Yoshida of Japan Agency for Marine-Earth Science and Technology.

8.4 Workplan (items by year)

The work schedule should be prepared bearing in mind that, as a rule, projects will be accepted for a duration of five years maximum. The work schedule should include field and laboratory work, meetings, field trips, conferences, etc. ***Maximum length: 1,500 words***.

Year 1

- Organise the first project meeting at a major international conference after project approval to:
  (1) discuss/formalise project goals, project products, and project work plan;
  (2) formalise project structure (including appointing Project Secretary, and forming major Working Parties with clear leadership for each working party);
  (3) identify key field regions and experiments (modelling), and form major multinational and multidisciplinary collaborative ties to work in these regions/experiments;
  (3) attract wider participation by researchers from around the world.
- Countries with large numbers of participants and major field programs to form national Working Groups, endorsed by respective IGCP national committees and the project leadership team.
- Organise the first project-specific Field Symposium at a selected field region that is critical for achieving project aims (see **8.1** and **8.7**).
- Organise a database workshop either as a part of the Field Symposium/meeting special sessions, or as a separate event, where key personnel of the database Working Party will agree on major tasks, and assign responsibilities.
- Organise a journal special issue on supercontinent cycle in honour of retiring Professor Damian Nance who wrote perhaps the first paper on supercontinent cycle back in the 1980s and who has made outstanding contribution to the debate since then.

- Organise at least one project-sponsored session/symposium at a major international conference.
- Start collaborative research within and between the Working Parties (e.g., supercontinent cycles, databases, and geodynamics) toward the three major project goals.

Year 2

- On-going collaborative research within and between the three Working Parties toward the three major project goals.
- Organise second Field Symposium at a targeted strategic field region that is relevant to achieving project aims (see **8.1** and **8.7**). Progress in the past year will be reviewed, and new results relevant to aims 1 and 3 will be updated and utilised for better-constrained geodynamic modelling.
- Organise 1–2 special project-sponsored sessions/symposia at major international conferences.
- The database Working Party will meet to discuss progresses, identify problems, and design future work. This could be a separate event, or as a part of the other symposia/special sessions. Continue to work on fatabases.

Year 3

- On-going collaborative research within and between the three Working Parties toward the three major project goals.
- Organise the third Field Symposium at a targeted strategic field region that is relevant to achieving project aims (see **8.1** and **8.7**).
- Organise 1–2 special project-sponsored sessions/symposia at major international conferences.
- Organise a project-sponsored journal special issue or book.

Year 4

- On-going collaborative research within and between the three Working Parties toward the three major project goals.
- Organise the final Field Symposium at a targeted strategic field region that is relevant to achieving project aims (see **8.1** and **8.7**).
- Organise 1–2 special project-sponsored sessions/symposia at major international conferences.
- A workshop to discuss the final products of the project utilising all research outcomes.

Year 5

- On-going collaborative research within and between the three Working Parties toward the three major project goals.
- Organise fourth Field Symposium at a targeted strategic field region that is relevant to achieving project aims (see **8.1** and **8.7**).
- Organise 1–2 special project-sponsored sessions/symposia at major international conferences.
- Possibly organise a concluding symposium in Western Australia on Supercontinent Cycles and Global Geodynamics, and possibly associated workshop(s) on

supercontinent reconstruction (using GPlates and databases), palaeomagnetism, geodynamic modelling, and how to use the global databases.

- Organise a project-sponsored journal special issue or book to summarise the final outcomes of the project.

8.5 Results expected

Results expected should be specified as precisely as possible in respect of theoretical and applied science (including general applications where these are foreseen), as well as anticipated societal benefits. Outcomes should include both those expected at the end of the project as well as those to be achieved at the end of each year for which funding is requested. Meetings and conferences are not considered as results. ***Maximum length: 2,000 words.***

a) Results expected in basic sciences

This project will produce the following scientific outcomes:

1. More robust reconstructions of the Paleo(?)-Mesoproterozoic supercontinent Nuna/Columbia, the Neoproterozoic supercontinent Rodinia, and the Phanerozoic supercontinents Pangaea (with Gondwana being a part), including the timing and processes of their assembly and breakup, and their respective configurations. This will be achieved by new palaeomagnetic, geological, geochronological, and geochemical constraints, particularly those from critical regions and continental blocks. The work will be aided by the newly constructed/refined global GIS-based databases compatible to the GPlates software.

2. A continuous global palaeogeography from ca. 2000 Ma to the present.

3. A much improved understanding of how mineral deposits and large igneous provinces (LIPs) distribute in time and space through Earth history, and how were they linked to the supercontinent cycles. Major scientific findings will be published in the literature.

4. A much improved understanding of how tectonic plates and major mantle events/phenomena (e.g., plume/superplume events) interact, thus more robust geodynamic model (or models).

5. A series of globally consistent, GIS-based, and GPlates-friendly geotectonic and mineral deposit databases that will be made available to the broad scientific community as well as industry.

6. A number of journal special issues or books, and on average no fewer than 50 scientific articles each year, to present the new scientific findings.

b) Results expected in applied sciences and technology

1. A new understanding of first-order controls on the uneven distribution of mineral deposits in time and space, which will help the resource industry explore for new mineral deposits and government earth science institutions to plan targeted mapping/resource programmes. This will be achieved through relational analyses between the occurrence/distribution of mineral resources and the global geotectonic/geodynamic evolution, and numerical modelling.

2. Sets of databases that can be easily applied, interrogated, manipulated, and visualised using the GPlates plate reconstruction program. This database-software package will become a must-have tool for palaeogeographic reconstruction, geotectonic, geodynamic, and earth resource analyses, available to the entire geoscience community.

c) Results expected in respect of benefit to society

This project will benefit the society in a number of ways.

First, the expected breakthrough science will provide new understanding of how the Earth has evolved and how the complex Earth system works. Such new knowledge will be transmitted to the broader community through popular science articles, popular books (for instance, popular textbook "*Earth Science Today*" by project members Profs. Brendan Murphy and Damian Nance; the Rodinia Map and animation produced by IGCP440 have been used by schools, university lecturers, and textbooks, with the Rodinia Map also hanging on walls of many geoscience institutions and offices), and through internet postings.

Second, the project, joined by researchers from all inhabited continents, including many from less developed countries, will act as a platform for broadest possible cross-disciplinary and cross-national collaborations. The active participants of a large member of world-leading researchers supported by world-class analytical facilities will ensure access to both the latest thinking and cutting-edge technologies by researchers (including young researchers and graduate students) from less-developed countries. As a result, the broader international science community will benefit from the participation of researchers, at the same time the project will help to enhance the research standard and capabilities of those less developed nations.

Third, both the new scientific understanding, and the databases and tools developed through this project, will assist the discovery of Earth resources that are needed to sustain the development of societies. The new geodynamic models and two billion years of global palaeogeography will also be used by the climate modelling community to simulate first-order controls on our evolving environment and climate (for instance, the Neoproterozoic Snowball Earth events, and the oxygenation of Earth's hemisphere).

The global participation of the project will help to bring people from different cultures and religions together, thus facilitate cross-culture and cross-nation understanding and global harmony.

8.6 Participation

Provide a list of contributors to the project and the areas to which they will contribute. Applicants should note that an important aim of this program is to encourage involvement of scientists from the developing countries.

a) countries or institutions (or individuals) which have already agreed to co-operate

*This implies a **formal commitment** supported by written confirmation. Names and addresses should be listed.*

Up to the time of the proposal submission, we have received written commitments by >100 researchers from 25 countries, with a broad demographic range (e.g., from world authorities to *graduate students*). We list below participants by countries:

Country	***Family name***	***Given name***	***Institution***
Argentina			
Dr	Gimenez	Mario Ernesto	Uni. Nacional de San Juan
Prof	Vujovich	Graciela I.	University of Buenos Aires
Australia			
Dr	Belousova	Elena	Macquarie University
A/Prof	Betts	Peter G.	Monash University
Prof	Collins	Alan	Adelaide University
Prof	Fitzsimons	Ian	Curtin University
Dr	Glorie	Stijn	Adelaide University
Dr	Huston	David	Geoscience Australia

Prof	Li	Zheng-Xiang	Curtin University
Prof	Müller	Dietmar	University of Sydney
Dr	O'Neill	Craig	Macquarie University
Dr	Pisarevsky	Sergei	Curtin Uni./Uni. of WA
Prof	Reddy	Steven	Curtin University
Prof	Rasmussen	Birger	Curtin University
Ms	*Stark*	*J. Camilla*	*Curtin University*
Mr	*Tetley*	*Michael*	*University of Sydney*
Dr	Yao	Weihua	Curtin University

Belgium

Prof	Sintubin	Manuel	Katholieke Universiteit Leuven

Botswana

A/Prof	Kehelpannala	K.V. Wilbert	University of Botswana

Brazil

Dr	Almeida	Julio	Uni. do Estado do Rio de Janeiro
Prof	Heilbron	Monica	Rio de Janiero State University
Prof	Pedrosa-Soares	Antonio Carlos	Uni. Federal de Minais Gerais
Dr	Schmitt	Renata	Uni. Federal do Rio de Janeiro
Prof	Teixeira	Wilson	University of Sao Paolo

Canada

Prof	Ansdell	Kevin	University of Saskatchewan
Prof	Bethune	Kathryn	University of Regina
Dr	Buchan	Ken	Geological Survey of Canada
Prof	Dostal	Jaroslav	Saint Mary's University
Prof	Eglington	Bruce	University of Saskatchewan
Prof	Ernst	Richard E.	Carleton University
A/Prof	Halverson	Galen	McGill University
Prof	Johnston	Stephen	University of Victoria
Prof	Murphy	Brendan	St. Francis Xavier University
Assis. Prof	Partin	Camille	University of Saskatchewan
Dr	Pehrsson	Sally	Geological Survey of Canada
Prof	Rivers	Toby	Memorial Uni. of Newfoundland
Prof	Thorkelson	Derek	Simon Fraser University

Czech Republic

Dr	Hajna	Jaroslava	University of Prague
A/Prof	Žák	Jiří	University of Prague

China

Dr	Li	Xian-Hua	Chinese Academy of Sciences
Prof	Zhang	Shihong	China University of Geosciences
Prof	Zhao	Guochun	University of Hong Kong

Egypt

Prof	Hamimi	Zakaria	Benha University

Finland

Dr	Salminen	Johanna	University of Helsinki
France			
Dr	Pin	Christian	Universite Blaise Pascal & CNRS
Germany			
Prof	Bahlburg	Heinrich	University of Muenster
Dr	Bauer	Wilfried	Geologisches Institut RWTH
Prof	de Wall	Helga	Universitat Erlangen-Nurnberg
Mr	*Gärtner*	*Andreas*	*Senckenberg Museum*
Ms	Hofmann	Mandy	Senckenberg Museum
Prof	Linnemann	Ulf	Senckenberg Museum
Dr	Steinberger	Bernhard	GFZ German Research Centre
India			
Prof	Kochhar	Naresh	Panjab University
Prof	Mamtani	Manish	Indian Institute of Technology
Prof	Pandit	Manoj K.	University of Rajastan
Prof	Ray	Jyotisankar	University of Calcutta
Japan			
Dr	Yoshida	Masaki	Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
Korea			
Assis. Prof	Kim	Yoonsup	Chungbuk National University
Mexico			
Prof	Weber	Bodo	CICESE (Ensenada Centre for Scientific Research and Higher Education)
Netherlands			
Dr	Pastor-Galan	Daniel	Utrecht University
New Zealand			
Dr	Adams	Christopher	Geological and Nuclear Sciences
Norway			
Prof	Jacobs	Joachim	University of Bergen
Prof	Torsvik	Trond	University of Oslo
Portugal			
Dr	Fróis Dias da Silva	Ícaro	University of Lisbon
Dr	Henriques	Susana	National Laboratory for Energy and Geology
Russia			
Dr	Donskaya	Tatiana	Russian Academy of Sciences
Dr	Gladkochub	Dmitry	Russian Academy of Sciences
Prof	Khudoley	Andrei	St. Petersburg State University
Dr	Kuznetsov	Nikolay	Russian Academy of Sciences

Dr	Metelkin	Dmitry	Novosibirsk State University
Dr	Romanyuk	Tatiana	Russian Academy of Sciences
Dr	Stepanova	Alexandra	Russian Academy of Sciences
Dr	Vernikovskaya	Antonina E.	Institute of Petroleum Geology
Prof	Vernikovsky	Valery A.	Novosibirsk State University
South Africa			
Dr	De Kock	Michiel	University of Johannesburg
Dr	Linol	Bastien	Nelson Mandela Metropolitan University
Spain			
Prof	Arenas	Ricardo	Universidad Complutense Madrid
Dr	Diez Fernandez	Ruben	Universidad Complutense Madrid
Prof	Galindo	Carmen	Universidad Complutense Madrid
Dr	Gonzalez Clavijo	Emilio	Instituto Geologico y Minero de Espana
Prof	Gutierrez-Alonso	Gabriel	Universidad de Salamanca
Prof	Lopez-Carmona	Alicia	Universidad Complutense Madrid
Prof	Quesada	Cecilio	Universidad Complutense Madrid
Dr	Sanchez Martinez	Sonia	Universidad Complutense Madrid
Sweden			
Mr	*Gumsley*	*Ashley*	*Lund University*
Dr	Johansson	Ake	Swedish Museum of Natural History
Prof	Soderlund	Ulf	Lund University
Turkey			
Dr	Sen	Gul	Yil University
USA			
Prof	Becker	Thorsten	University of Southern California
Assis. Prof	Bekker	Andrey	University of California Riverside
Dr	Bradley	Dwight	U.S. Geological Survey
Prof	Brown	Michael	University of Maryland
Prof	Condie	Kent	New Mexico Institute of Mining and Technology
Prof	Evans	David	Yale University
Prof	Hatcher	Robert D.	University of Tennessee
Prof	Kay	Suzanne M.	Cornell University
Prof	King	Scott	Virginia Tech
Prof	Meert	Joseph	University of Florida
Prof	Mueller	Paul	University of Florida
Prof	Nance	Damian R.	Ohio University
Prof	Riggs	Nancy	Northern Arizona University
Dr	Zhang	Nan	Woods Hole Oceanographic Institute
Prof	Zhong	Shijie	University of Colorado Boulder

b) countries likely to participate

Estimate the range of participation of those countries who have shown interest in the project but whose written commitment is still awaited.

The above participant list was compiled during the initiation stage of this proposal over just a few weeks' time. We anticipate that once approved, the project will receive a much broader response and participation from researchers around the world, particularly many more from the developing countries and an increasing number of graduate students. More participants are anticipated for most of the countries listed above. In addition, we expect participations from both geologists, geodynamists and people interested in database development and resource exploration from the following countries and beyond:

Chile, Greenland, Ireland, Israel, Italy, Kuwait, Madagascar, Poland, South Korea, Sri Lanka, the U.K., and Vietnam.

8.7 Location of major field activities
State the principal locations of any planned field investigations.

As the reconstruction of global palaeography through the past two billion years will involve systematic geotectonic and palaeomagnetic investigations of all continental blocks, field activities by project participants will likewise cover every continent. However, we intend to select five of the most appropriate field regions to address some of the key questions and knowledge gaps in our understanding of supercontinent cycle and related geodynamic processes. We proposed in our work plan (**8.4**) to have one (and possibly two) project-sponsored Field Symposia each year. In their initial response, members suggested many important and strategic field regions. Below we list some of the suggested locations each year's project-wide field activities.

Year 1: As this will be the foundation year of the project with a relative short duration available for preparing and organising the field symposium, we will select a well-developed region where logistics for a field symposium can be organised with a relatively short notice. This field symposium will bring the geodynamic community and the supercontinent community together to discuss way forward in combining key geotectonic information to global geodynamic modelling. We will have the field symposium at a location relevant to mantle plume: either Hawaii (proposed by Prof. Ken Condie) or Yellowstone (proposed by Co-Leader David Evans). The fieldtrip will examine the modern example of mantle plume activity that is generated either atop the Pacific the lower mantle LLSVP (Hawaii) or away from the LLSVP (Yellowstone). We will discuss ways to identify past plume activities (particularly those of the oceanic realm), ways to distinguish these two types of plumes.

Year 2: In 2016 this IGCP project will also co-sponsor the prescheduled Rodinia meeting and field workshop, to be held at Whitehorse, Yukon (Canada). The fieldtrip on Mackenzie Mountains Meso- to Neoproterozoic tectonostratigraphy, which is a key for testing the Laurentia-Australia connection in Nuna, and the assembly and breakup history of both Nuna and Rodinia, will be led by A/Prof. Galen Halverson of McGill University and others.

Years 3-5: Rather than impose a particular meeting agenda at this time, we will canvass participants for their ideas upon inception of the project, including the possibility of organising field symposia jointly with IGCP 628. Prospective field workshop locations include:

(1) The southern Siberian margin: Nuna and Rodinia configurations and breakup processes. Committed organiser: Dr Dmitry Gladkochub, Director of the Institute of Earth’s Crust, Russian Academy of Sciences.

(2) The Isa belt in NE Australia/Nuna assembly process and configuration — a region to be compared with the Alaska margin of Laurentia. Committed organisers: Dr. George Gibson of Australian National University who organised a successful IGC field excursion to the region in 2012, and others working in the region.

(3) East North America orogenic belts and rift zones: record of supercontinent cycles. Proposers: Prof. Kathryn Bethune of the University of Regina, Prof. Brendan Murphy of St. Francis Xavier University, Prof. Damian Nance of Ohio University, and Prof. Ulf Linnemann of Senckenberg Museum.

(4) Madagascar: a section through the central part of the East African Orogen. Proposer: Dr. Wilfried Bauer of Geologisches Institut RWTH Aachen.

(5) Eastern Africa: Proterozoic orogens and modern rift systems. Proposers: Prof. Allan Collins of Adelaide University, and Prof. Damian Nance of Ohio University.

(6) Southern Africa: A traverse across the Archaean-Paleoproterozoic Limpopo Mobile Belt in NE Botswana (proposer A/Prof. Wilbert Kehelpannala of University of Botswana), or the Neoproterozoic Damara Belt (proposer Dr Renata Schmitt of University Federal do Rio de Janeiro).

(7) Eastern Brazil: modern passive-margin mountains and Neoproterozoic orogens. Proposers: Prof. Monica Heilbron of Rio de Janiero State University, Dr Julio Almeida Universidade do Estado do Rio de Janeiro, and Prof. Antonio Carlos Pedrosa-Soares of Universidade Federal de Minais Gerais.

(8) Record of Nuna and Rodinia assembly and break in North China or South China. Proposer: Prof. Shihong Zhang of China University of Geosciences, and Prof. Michael Brown of University of Maryland.

(9) Central and southern Indian Paleo-Mesoproterozoic orogens, and the Malani and Deccan traps LIPs. Proposers: Prof. Allan Collins of Adelaide University, Prof. Joe Meert of University of Florida, and Prof. Manoj Pandit of University of Rajastan.

(10) Suture zones and rifting record Iberia (Portugal/Spain): Rodinia to Pangea supercontinent cycles. Proposers: Dr. Daniel Pastor-Galan of Utrecht University, Dr. Susana Henriques of National Laboratory for Energy and Geology (Portugal), Prof. Gabriel Gutierrez-Alonso of Universidad de Salamanca, Prof. Cecilio Quesada of Universidad Complutense Madrid, and Dr. Ícaro Fróis Dias da Silva of University of Lisbon.

8.8 Location of major laboratory research (assured co-operation of laboratories)
State names and locations of laboratories that have agreed to conduct laboratory work.

There are multiple major isotopic/geochemical laboratories, palaeomagnetic laboratories, geodynamic modelling laboratories, and regional tectonic and mapping laboratories including GIS-database management laboratories) that will be used for collaborative research during this project. We list just some of them below:

Name of major collaborating laboratories	**Locations**
Isotopic/geochemical laboratories	
John De Laeter Centre for Isotope Research	Perth, Australia
Uni Adelaide isotopic and thermochronological laboratories	Adelaide, Australia
GEMOC Geochemical Analysis Unit	Sydney, Australia
RSES Geochemistry Group with access to SHRIMP, especially light isotopes and geochron	Canberra, Australia
Rio de Janeiro State Uni Geochronology and Geochemistry labs	Rio de Janeiro, Brazil
Geochronological Research Center at Uni São Paulo	Sao Paolo, Brazil
Isotopic Microanalysis Research Center of IGG-CAS	Beijing, China
CICESE isotope laboratory	Ensenada, Mexico
SHRIMP lab. & ILA-MC-ICP-MS at Korea Basic Science Institute	Daejeon, Korea
African Earth Observatory Network - Earth Stewardship Research Institute	Port Elizabeth, South Africa
Isotope Geochemistry and Geochronology Centre at Uni	Madrid, Spain

Complutense	
Lund Uni U-Pb TIMS, U-Pb LA-ICPMS	Lund, Sweden
Laboratory for Isotope Geology at the Museum	Stockholm, Sweden
Cornell Uni geochemical and isotopic laboratory	New York, USA
Florida Center for Isotope Geoscience at Uni Florida	Florida, USA
Palaeomagnetic laboratories	
WA Palaeomagnetic and Rock-magnetic Facility	Perth, Australia
CUGB Paleomagnetism and environmental magnetism laboratory	Beijing, China
Laboratory of Rock Magnetism	Prague, Czech Repub.
Solid Earth Geophysics laboratory at Uni Helsinki	Helsinki, Finland
Uni Erlangen-Nuremberg Rockmagnetic and SEM-EBSD facilities	Erlangen, Germany
Utrecht Uni Paleomagnetic Laboratory "Fort Hoofddijk"	Utrecht, Netherlands
National Geomagnetic Laboratory in Norway	Oslo, Norway
Laboratory of geodynamics and paleomagnetism IPGG	Novosibirsk, Russia
Uni Johannesburg Paleomagnetic Laboratory	Johannesburg, S Africa
Lund Uni Paleomagnetic laboratory	Lund, Sweden
Yale Uni Paleomagnetic Laboratory	New Haven, USA
Uni Florida Paleomagnetic Laboratory	Florida, USA
Geodynamic modelling laboratories	
The EarthByte Group modelling lab	Sydney, Australia
CCFS Geodynamic Modelling Group modelling lab	Sydney, Australia
Geodynamic Modelling Lab GFZ German Research Centre	Potsdam, Germany
JAMSTEC Geodynamic Modelling Lab	Yokosuka, Japan
Laboratory of the Geodynamics and Tectonophysics	Moscow, Russia
Virginia Tech Geodynamic Modelling Lab	Blacksburg, USA
Geodynamic Modelling Lab at Uni Colorado	Boulder, USA
Geodynamic Modelling Lab at Uni Southern California	Los Angeles, USA
Regional tectonic and mapping laboratories	
Let - Laboratoria de Estudos Rectonicos. (Tectonics and geodynamics studies, Geological Digital Cartography)	Rio de Janeiro, Brazil
Gondwana Digital Center of Geoprocessing (GDCG) at Universidade Federal do Rio de Janeiro	Rio de Janeiro, Brazil
Geological Mapping and Digital Cartography Laboratory at Universidade Federal de Minas Gerais	Belo Horizonte, Brazil
National Laboratory for Energy and Geology	Alfragide, Portugal
Paleogeodynamics laboratory, Russian Academy of Sciences	Irkutsk, Russia
Laboratory of the Late Precambrian and Phanerozoic Geodynamics	Moscow, Russia
Laboratory of Petrology and Tectonics, Karelian Research Centre, Russian Academy of Sciences	Petrozavodsk, Russia
Uni Maryland Laboratory for Crustal Petrology	Maryland, USA

8.9 Scientific Legacy: Is there a need for storage of publications, field data, and other results of the project? *Do you have a clear vision concerning where the data would be stored and who will be the custodian?*

All palaeomagnetic data will be stored in the MagIC global palaeomagnetic database (http://earthref.org/MAGIC/), established by an international consortium and stored at the San Diego Supercomputer Center. It is freely accessible through the EarthRef.org website that covers Earth Science Reference Data and Models.

The GIS-based geological databases, linking to the DateView (currently the only global geochronology database with more than 107,000 records) and StratDB databases at the

University of Saskatchewan, are already designed to capture global geochronology and isotope geochemical information, together with ore deposit, large igneous province, lithostratigraphy and tectonic information (Eglington et al, 2009, 2013). Interfaces to MagIC will be developed. Polygon definitions of plates to be included in plate reconstructions will be improved so as to facilitate the development of the reconstructions. Both DateView and StratDB have been in existence for more than a decade and have been housed at the University of Saskatchewan but longer-term replication at other nodes should be implemented so as to ensure their continued availability for future researchers. A group of champions for the various datbases and their interfaces will be identified during this IGCP project so as to keep the databases active subsequent to the end of the project. Continued enhancement of the databases, their content and their web interfaces will promote the addition of more and new data.

Web interfaces to these databases already exist and provide mechanisms to illustrate regional geological variations in time-space correlation charts, time-slice maps and plate reconstructions. These capabilities will be enhanced and further developed to work with newer data sets such as hafnium in zircons and to better integrate with palaeomagnetic information.

8.10 Budget

Outline how the IGCP funds will be spent over the proposed duration of the project. Be sure to specify specific IGCP expenditures (see allowable items in "Guidelines" section 7). List other potential sources of funds and how IGCP funds may help in leveraging funds from other organizations. Provide a realistic estimate of the total cost (including non-IGCP sources) of the project, itemizing expenditures such as fieldwork expenses, laboratory costs, meetings, etc. (even though such costs may not be charged to IGCP).

Annual budget for the IGCP, expected at a level of USD10,000/a:

Partial support for researchers from less developed countries to participate in project activities, $700/each x 5	$3500
Partial support for PhD students to participate in project activities, $700/each x 5	$3500
Organisation of workshops and field symposium (venue renting costs, and tea/coffee catering costs	$2000
Administration costs	$1000
Total	**$10,000**

8.11 Curriculum Vitae of proposer(s)

CVs of proposed leader(s) should be limited to three pages and include key publications (international peer-reviewed publications only), relevant scientific experience, any previous involvement in IGCP and/or other international research cooperation programs, including the organization of international meetings.

Zheng-Xiang Li

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Tel: +61 8 9266 2453 Fax: +61 8 9266 3153 Email: z.li@curtin.edu.au

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Employment History

2007–present	Professor, Department of Applied Geology, Curtin University.
2006	Senior Principal Research Fellow/Professor, Tectonics Special Research Centre, School of Earth and Geographical Sciences, The University of Western Australia.
2001–2005	Principal Research Fellow, Tectonics Special Research Centre (TSRC), School of Earth and Geographical Sciences, The University of Western Australia (2001– 2006). Deputy Director of the TSRC (2000-2003).
1995–2001	Senior Research Fellow, Tectonics Special Research Centre, The University of Western Australia. ARC Queen Elizabeth II Fellow (1995–1999).
1990–1994	Research Fellow/Research Associate, Department of Geology and Geophysics, The University of Western Australia.
1988–1990	Post-Doctoral Fellow, School of Earth Sciences, Macquarie University.

Academic Qualifications:

Ph.D. (1989) in palaeomagnetism and tectonics, Macquarie University
B.Sc. (1982) in seismological geology, Peking University

Professional activities

- **Project Co-leader, IGCP 440**: Rodinia Assembly and Breakup, 2002–2004; **Project Secretary** of the same project, 1999–2002. IGCP 440 is an "example of an especially successful IGCP project emphasizing basic research" (IGCP Guidelines for new project applications, p. 11).
- **Project Co-leader, IGCP581**: Evolution of Asian River Systems Linking to Cenozoic Tectonics, Climate and Global Geochemical Cycles, 2009–2013.
- **Members of IGCP 509**: Paleoproterozoic Supercontinents and Global Evolution (2005-2009); **IGCP 411**: Geodynamics of Gondwanaland-derived Terranes in East and South Asia (1998-2003); **IGCP 368**: Proterozoic Events in East Gondwana (1995-1999); **IGCP 321**: Gondwana Dispersion and Asian Accretion (1991-1995); **IGCP 288**: Gondwanaland Sutures and Fold Belts (1990-1994); **IGCP 276**: Paleozoic Terranes in the Circum-Pacific Orogens (1989-1993).
- Associate Editor, GSA Bulletin (2007-2009; 2012-present);
- Editorial Board member, Journal of Asian Earth Sciences (2006-present);
- Editorial Board member, Chinese Science Bulletin (2003-2004);
- Editorial Board member, Acta Geoscientia Sinica (2001-present);
- Editorial Board member, Acta Geologica Sinica (2013-present).

Research interests:

- Evolution of supercontinents since the Proterozoic (Rodinia, Gondwanaland, Pangaea);
- Roles of mantle plumes in supercontinent evolution;
- Tectonics of East Asia and Australia (including orogenic and basin histories);
- Tectonic control of major mineral systems;

- Palaeomagnetism, rock-magnetism, and applications to mineral and petroleum industries and environmental studies.

Selected, relevant publications:

1. Pisarevsky, S.A. Elming, S-Å., Pesonen, L., Li, Z.X.: Mesoproterozoic paleogeography: supercontinent and beyond. *Precambrian Research* 244, 207-255, 2014.
2. Yao, W.H., Li, Z.X., Li, W.X., Li, X.H., Yang, J.H.: From Rodinia to Gondwanaland: A tale of detrital zircon provenance analyses from the southern Nanhua Basin, South China. *Am. J. Sci.* 314, 278–313, 2014.
3. Li, Z.X., Evans, D.A.D., Haverson, G.: Neoproterozoic glaciations in a revised global palaeogeography from the breakup of Rodinia to the assembly of Gondwanaland. *Sed. Geol.* 294, 219-232, 2013.
4. Smirnov, A. V., Evans, D. A. D., Ernst, R. E., Söderlund, U., and Li, Z.X.: Trading partners: Tectonic ancestry of southern Africa and western Australia, in Archean supercratons Vaalbara and Zimgarn. *Precambrian Res.* 224, 11-22, 2013.
5. Zhang S., Li, Z.X., Evans, D.A.D., Wu., H., Li, H., Dong, J.: Pre-Rodinia supercontinent Nuna shaping up: A global synthesis with new paleomagnetic results from North China. *Earth Planet. Sci. Lett.* 353–354, 145–155, 2012.
6. Wang, X.C., Li, Z.X., Li, X.H., Li, J., Liu, Y., Long, W.G., Zhou, J.B., Wang, F.: Temperature, pressure, and composition of the mantle source region of late Cenozoic basalts in Hainan Island, Southeastern Asia: a consequence of a young thermal mantle plume close to subduction zones? *J. Petrol.* 33 (1), 177-233, 2012.
7. Li, Z.X., Breakup of Rodinia. In Reitner, J. and Thiel, V. (eds.), Encyclopaedia of Geobiology, Springer, pp. 206-210, 2011.
8. Li, Z.X., Evans, D.A.D.: Late Neoproterozoic 40° intraplate rotation within Australia allows for a tighter-fitting and longer-lasting Rodinia. *Geology* 39, 39–42, 2011.
9. Zhang, N., Zhong, S., Leng, W., Li, Z.X.: A model for the evolution of the Earth's mantle structure since the Early Paleozoic. *J. Geophys. Res. - Solid Earth*, 115, B06401, 2010.
10. Zhang, C.L., Li, Z.X., Li, X.H., Xu, Y.G., Zhou, G., Ye, H.M.: A Permian large igneous province in Tarim and Central Asian Orogenic Belt, NW China: Results of a ca. 275 Ma mantle plume? *GSA Bull.* 122(11-12), 2020-2040.
11. Wang, X.C., Li, X.H., Li, Z.X., Liu, Y., Yang, Y.H.: The Willouran Basic Province of South Australia: its relation to the Guibei Large Igneous Province in South China and the breakup of Rodinia. *Lithos* 119, 569–584, 2010.
12. Li, Z.X., Zhong, S.: Supercontinent-superplume coupling, true polar wander and plume mobility: plate dominance in whole-mantle tectonics. *Physics of Earth and Planetary Interiors* 176, 143-156, 2009.
13. Hoffman, P.F., Li, Z.X.: A palaeogeographic context for Neoproterozoic glaciation. *Palaeogeography, Palaeoclimatology, Palaeoecology* 277, 158–172, 2009.
14. Li, Z.X., Bogdanova, S.V., Collins, A.S., Davidson, A., De Waele, B., Ernst, R.E., Fitzsimons, I.C.W., Fuck, R.A., Gladkochub, D.P., Jacobs, J., Karlstrom, K.E., Lu, S., Natapov, L.M., Pease, V., Pisarevsky, S.A., Thrane, K., Vernikovsky, V.: Assembly, configuration, and break-up history of Rodinia: A synthesis. *Precambrian Res.* 160 (1-2), 179-210, 2008.
15. Li, Z.X., Li, X.H., Li, W.X., Ding, S.: Was Cathaysia part of Proterozoic Laurentia? – new data from Hainan Island, South China. *Terra Nova* 20 (2), 154-164, 2008.
16. Ernst, R.E., Wingate, M.T.D., Buchan, K.L., Li, Z.X.: Global record of 1600–700 Ma Large Igneous Provinces (LIPs): Implications for the reconstruction of the

proposed Nuna (Columbia) and Rodinia supercontinents. *Precambrian Res.* 160(1-2), 159-178, 2008.

17. Zhong, S., Zhang, N., Li, Z.X., Roberts, J.H.: Supercontinent cycles, true polar wander, and very long-wavelength mantle convection. *Earth Planet. Sci. Lett.* 261, 551-564, 2007.
18. Wang, X.C., Li, X.H., Li, W.X., Li, Z.X.: Ca. 825 Ma komatiitic basalts in South China: First evidence for >1500°C mantle melts by a Rodinia mantle plume. *Geology* 35(12), 1103–1106, 2007.
19. Li, Z.X., Evans, D.A.D. and Zhang, S.: A 90º spin on Rodinia: Possible causal links between the Neoproterozoic supercontinent, superplume, true polar wander and low-latitude glaciation. *Earth Planet. Sci. Lett.* 220, 409-421, 2004.
20. Li, Z.X., Li, X.H., Kinny, P.D., Wang, J., Zhang, S., Zhou, H.: Geochronology of Neoproterozoic syn-rift magmatism in the Yangtze Craton, South China and correlations with other continents: evidence for a mantle superplume that broke up Rodinia. *Precambrian Res.* 122, 85-109, 2003.
21. Li, X.H., Li, Z.X., Ge, W., Zhou, H., Li, W., Liu, Y., Wingate, M.T.D.: Neoproterozoic granitoids in South China: crustal melting above a mantle plume at ca. 825 Ma? *Precambrian Res.* 122, 45-83, 2003.
22. Wang, J., Li, Z.X.: History of Neoproterozoic rift basins in South China: implications for Rodinia breakup. *Precambrian Res.* 122, 141-158, 2003.
23. Li, Z.X., Li, X.H., Zhou, H. and Kinny, P.D.: Grenvillian continental collision in South China: New SHRIMP U-Pb zircon results and implications for the configuration of Rodinia. *Geology* 30, 163-166, 2002.
24. Li, X.-H., Li, Z.X., Zhou, H., Liu, Y., Kinny, P.D.: U-Pb zircon geochronology, geochemistry and Nd isotopic study of Neoproterozoic bimodal volcanic rocks in the Kangdian Rift of South China: implications for the initial rifting of Rodinia. *Precambrian Res.* 113: 135-154, 2002.
25. Li, Z.X. and Powell, C. McA.: An outline of the Palaeogeographic evolution of the Australasian region since the beginning of the Neoproterozoic. *Earth-Sci. Rev.* 53, 237-277, 2001.
26. Li, Z.X.: New palaeomagnetic results from the “cap dolomite” of the Neoproterozoic Walsh Tillite, northwestern Australia. *Precambrian Res.* 100, 359-370, 2000.
27. Li, Z.X.: Palaeomagnetic evidence for unification of the North and West Australian Cratons by ca. 1.7 Ga: new results from the Kimberley Basin of northwestern Australia. *Geophys. J. Int.* 142, 173-180, 2000.
28. Li, Z.X., Li, X.H., Kinny, P.D. and Wang, J.: The breakup of Rodinia: did it start with a mantle plume beneath South China? *Earth Planet. Sci. Lett.* 173, 171-181, 1999.
29. Li, Z.X., Zhang, L. and Powell, C.McA.: Positions of the East Asian cratons in the Neoproterozoic supercontinent Rodinia. In: Z.X. Li, I. Metcalfe and C. McA. Powell (guest editors), *Breakup of Rodinia and Gondwanaland and assembly of Asia*, *Aust. J. Earth Sci.* 43(6), 593-604, 1996.
30. Li, Z.X., Zhang, L. and Powell, C.McA.: South China in Rodinia: Part of the missing link between Australia–East Antarctica and Laurentia? *Geology* 23(5), 407-410, 1995.
31. Powell, C.McA., Li, Z.X., McElhinny, M.W., Meert, J.G. and Park, J.K.: Paleomagnetic constraints on timing of the Neoproterozoic breakup of Rodinia and the Cambrian formation of Gondwana. *Geology* **21**, 889-892, 1993.

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Employment and education

2009–	Professor of Geology & Geophysics, Yale University, New Haven, CT *Research and teaching in global tectonics and longterm trends in Earth's evolution. Head of the Yale paleomagnetic facility.*
2007–08	Associate Prof. of Geology & Geophysics, Yale University, New Haven, CT
2002–06	Assistant Prof. of Geology & Geophysics, Yale University, New Haven, CT
2002–05	Deputy Director, Tectonics Special Research Centre. *Leading the Yale-Harvard node of the Australian-funded TSRC. Globally collaborative research toward reconstruction of pre-Pangean supercontinents and elucidating their effects on mantle dynamics, global climate, and biological evolution.*
1998–'01	Postdoctoral research fellow, University of Western Australia, Perth, Australia. *Paleomagnetic and SHRIMP-geochronologic research to constrain the history of supercontinents and glaciations during the Proterozoic Eon. Field work in Australia and southern Africa.*
1994–98	California Institute of Technology (Caltech), Pasadena; Ph.D. in Geology
1992–94	California Institute of Technology (Caltech), Pasadena; M.S. in Geology
1988–92	Yale University, New Haven; B.S. in Geology & Geophysics

Principal research interests and experience:

Reconstruction of supercontinents through Earth history, using field- and laboratory-based paleomagnetic investigations. Assessment of supercontinental histories in the contexts of solid-Earth geodynamics and paleoenvironmental changes surrounding the evolution of life. Commitment to the combined endeavor of research, teaching, and academic administration.

Professional activities:

2006–	Associate Editor, *American Journal of Science*
2005–	Voting member, Subcommissions on Precambrian Stratigraphy and Neoproterozoic Stratigraphy (International Committee on Stratigraphy)
2005–	Member, Geological Association of Canada
2005–10	**Co-leader of UNESCO International Geoscience Program (IGCP) Project 509, "Palaeoproterozoic Supercontinents and Global Evolution"**
1999–'03	Associate Editor, *Tectonics*
1999–	Member, Geological Society of Australia
1992–	Member, Geological Society of America
1991–	Member, American Geophysical Union

Selected, relevant publications:

*student advisee †postdoctoral advisee (for work done under advisement)

1. Pehrsson, S., Eglington, B.M., Evans, D.A.D., Huston, D. & Reddy, S.M., in revision. Metallogeny and its link to orogenic style during the Nuna supercontinent cycle. *Geological Society of London Special Publication*.
2. Evans, D.A.D., Trindade, R.I.F., *Catelani, E.L., D'Agrella-Filho, M.S., Heaman, L.M., Oliveira, E.P., Söderlund, U., Ernst, R.E., †Smirnov, A.V. & †Salminen, J.M., in press. Return to Rodinia? Moderate to high paleolatitude of the São Francisco/Congo craton at 920 Ma. *Geological Society of London Special Publication*.
3. Evans, D.A.D., 2013. Reconstructing pre-Pangean supercontinents. *Geological Society of America Bulletin*, v. 125, p. 1735-1751.
4. Li, Z.-X., Evans, D.A.D. & Halverson, G.P., 2013. Neoproterozoic glaciations in a revised global paleogeography from the breakup of Rodinia to the assembly of Gondwanaland. *Sedimentary Geology*, v. 294, p. 219-232.
5. Zhang, S., Evans, D.A.D., Li, H., Wu, H., Jiang, G., Dong, J., Zhao, Q., Raub, T.D. & Yang, T., 2013. Paleomagnetism of Nantuo Formation and paleogeographic implications for the South China Block. *Journal of Asian Earth Sciences*, v.72, p.164-177.
6. Smirnov, A.V., Evans, D.A.D., Ernst, R.E., Söderlund, U. & Li, Z.-X., 2013. Trading partners: Tectonic ancestry of southern Africa and western Australia, in supercratons Vaalbara and Zimgarn. *Precambrian Research*, v.224, p.11-22.
7. Zhang, S., Li, Z.-X., Evans, D.A.D., Wu, H., Li, H. & Dong, J., 2012. Pre-Rodinia supercontinent Nuna shaping up: A global synthesis with new paleomagnetic results from North China. *Earth and Planetary Science Letters*, v.353-354, p.145-155.
8. *Mitchell, R.N., *Kilian, T.M. & Evans, D.A.D., 2012. Supercontinent cycles and the calculation of absolute palaeolongitude in deep time. *Nature*, v.482, p.208-211.
9. Evans, D.A.D. & *Mitchell, R.N., 2011. Assembly and breakup of the core of Paleo-Mesoproterozoic supercontinent Nuna. *Geology*, v.39, p.443-446.
10. Li, Z.-X. & Evans, D.A.D., 2011. Late Neoproterozoic 40° intraplate rotation within Australia allows for a tighter-fitting and longer-lasting Rodinia. *Geology*, v.39, p.39-42.
11. Evans, D.A.D. & Halls, H.C., 2010. Restoring Proterozoic deformation within the Superior craton. *Precambrian Research*, v.183, p.474-489.
12. Evans, D.A.D., 2009. The palaeomagnetically viable, long-lived and all-inclusive Rodinia supercontinent reconstruction. In: Murphy, J.B., Keppie, J.D. & Hynes, A., eds., Ancient Orogens and Modern Analogues. *Geological Society of London Special Publication*, v.327, p.371-404.
13. †De Kock, M.O., Evans, D.A.D. & Beukes, N.J., 2009. Validating the existence of Vaalbara in the Neoarchaean. *Precambrian Research*, v.174, p.145-154.
14. Payne, J.L., Hand, M., Barovich, K.M., Reid, A. & Evans, D.A.D., 2009. Correlations and reconstruction models for the 2500-1500 Ma evolution of the Mawson Continent. In: Reddy, S.M., Mazumder, R., Evans, D.A.D. & Collins, A.S., eds., Palaeoproterozoic Supercontinents and Global Evolution. *Geological Society of London Special Publication* v.323, p.319-355.

32. Eglington, B.M., Reddy, S.M. & Evans, D.A.D., 2009. The IGCP 509 Database System: Design and application of a tool to capture and illustrate litho- and chrono-stratigraphic information for Palaeoproterozoic tectonic domains. In: Reddy, S.M., Mazumder, R., Evans, D.A.D. & Collins, A.S., eds., Palaeoproterozoic Supercontinents and Global Evolution. *Geological Society of*

London Special Publication v.323, p.27-47.
33. Reddy, S.M. & Evans, D.A.D., 2009. Palaeoproterozoic supercontinents and global evolution: Correlations from core to atmosphere. In: Reddy, S.M., Mazumder, R., Evans, D.A.D. & Collins, A.S., eds., Palaeoproterozoic Supercontinents and Global Evolution. *Geological Society of London Special Publication* v.323, p.1-26.
15. †De Kock, M.O., Evans, D.A.D., Gutzmer, J., Beukes, N.J. & *Dorland, H.C., 2008. Origin and timing of BIF-hosted high-grade hard hematite deposits – a paleomagnetic approach. In: Hagemann, S., Rosiere, C., Gutzmer, J. & Beukes, N., eds., BIF-Related High-Grade Iron Mineralization. *Reviews in Economic Geology*, v.15, p.49-71.
16. Evans, D.A.D. & Pisarevsky, S.A., 2008. Plate tectonics on early Earth? -- weighing the paleomagnetic evidence. In Condie, K. & Pease, V., eds., When Did Plate Tectonics Begin? *Geological Society of America Special Paper*, v.440, p.249-263.
17. Pettersson, Å, Cornell, D.H., Moen, H.F.G., Reddy, S. & Evans, D., 2007. Ion-probe dating of 1.2 Ga collision and crustal architecture in the Namaqua-Natal Province of southern Africa. *Precambrian Research*, v.158, p.79-92.
18. Evans, D.A.D., 2006. Proterozoic low orbital obliquity and axial-dipolar geomagnetic field from evaporite palaeolatitudes. *Nature*, v.444, p.51-55.
19. Li Z.X., Evans D.A.D. & Zhang S., 2004. A 90° spin on Rodinia: Causal links among the Neoproterozoic supercontinent, superplume, true polar wander and low-latitude glaciation. *Earth and Planetary Science Letters*, v.220, p.409-421.
20. Evans D.A.D., 2003. True polar wander and supercontinents. *Tectonophysics*, v.362, p.303-320.
21. Wingate M.T.D. & Evans D.A.D., 2003. Palaeomagnetic constraints on the Proterozoic tectonic evolution of Australia. In: Yoshida M., Windley B. & Dasgupta S., eds, Proterozoic East Gondwana: Super Continent Assembly and Break-up, *Geological Society of London Special Publication* 206, p.77-91.
22. Pisarevsky S.A., Wingate M.T.D., Powell C.McA., Johnson S. & Evans D.A.D., 2003. Models of Rodinia assembly and fragmentation. In: Yoshida M., Windley B. & Dasgupta S., eds, Proterozoic East Gondwana: Super Continent Assembly and Break-up, *Geological Society of London Special Publication* 206, p.35-55.
23. Wingate M.T.D., Pisarevsky S.A. & Evans D.A.D., 2002. Rodinia connections between Australia and Laurentia: no SWEAT, no AUSWUS? *Terra Nova*, v.14, p.121-128.
24. Evans D.A.D., Gutzmer J., Beukes N.J. & Kirschvink J.L., 2001. Paleomagnetic constraints on ages of mineralization in the Kalahari Manganese Field, South Africa. *Economic Geology*, v.96, p.621-631.
25. Evans D.A.D., Li Z.X., Kirschvink J.L. & Wingate M.T.D., 2000. A high-quality mid-Neoproterozoic paleomagnetic pole from South China, with implications for ice ages and the breakup configuration of Rodinia. *Precambrian Research*, v.100, p.313-334.
26. Evans D.A., 1998. True polar wander, a supercontinental legacy. *Earth and Planetary Science Letters*, v.157, p.1-8.

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Educational background:

Ph.D. in *Geophysics and Scientific Computing*, 1994, (thesis advisor: M. Gurnis) University of Michigan
M.S. in *Geophysics*, 1988, Institute of Geophysics, Chinese Academy of Sciences
B.S. in *Geophysics*, 1985, University of Science and Technology of China

Academic employment history:

2010-present, Professor, University of Colorado at Boulder.
2004-2010, Associate Professor, University of Colorado at Boulder.
2000-2004, Assistant Professor, University of Colorado at Boulder.
1997-2000, Research Scientist, Massachusetts Institute of Technology.
1994-1997, Postdoctoral Research Fellow, California Institute of Technology.
1990-1994, Graduate Research Assistant, University of Michigan.
1988-1990, Research Assistant, Institute of Geophysics, Chinese Academy of Sciences.

Research:

Research interests:

1. Mantle convection and large-scale tectonics for Earth and other planets.
2. Viscoelastic and transient deformation of the Earth in response to glacial loads and sediments loads.
3. Deformational properties and rheology of the planetary mantles.
4. High performance computing.

Selected, relevant publications (graduate students are underlined):

1. Zhong, S.J. and A.B. Watts, Lithospheric deformation induced by loading of the Hawaiian Islands and its implications for mantle rheology, *J. Geophys. Res.*, 118, 6025-6048, 2013.
2. Liu, X. and S.J. Zhong, Analysis of marginal stability, heat transfer and boundary layer propoerties for thermal convection in a compressible fluid, *Geophys. J. Int.*, 194, 125-144, 2013.
3. Watts, A.B., S.J. Zhong, J. Hunter, The behavior of the lithosphere on seismic to geologic time-scales, *Annu. Rev. Earth Planet. Sci.*, 41, 443-468, 2013.
4. Geron, A, J. Wahr, and S.J. Zhong, Computations of the viscoelastic response of a 3-D compressible Earth to surface loading: an application to glacial isostatic adjustment in Antartica and Canada, *Geophys. J. Int.*, 192, 557-572, 2013.
5. Olson, P., R. Deguen, L. A. Hinnov, and S.J. Zhong, Controls on geomagnetic reversals and core evolution by mantle convection in the Phanerozoic, *Phys. Earth Planet. Inter.*, 214, 87-103, 2013.

6. Flowers, R.M., A.K. Ault, S.A. Kelley, N. Zhang, and S.J. Zhong, Epeirogeny or eustasy? Paleozoic–Mesozoic vertical motion of the North American continental interior from thermochronometry and implications for mantle dynamics, *Earth Planet. Sci. Lett.*, 317-318, 438-445, doi:10.1016/j.epsl.2011.11.015, 2012.
7. Zhang, N., S.J. Zhong, and R.M. Flowers, Predicting and testing continental motion histories since the Paleozoic, *Earth Planet. Sci. Lett*.. 317-318, 426-435, doi:10.1016/j.epsl.2011.10.041, 2012.
8. Jones, C.H., G.L. Farmer, B. Sageman, and S.J. Zhong, A hydodynamic mechanism for the Laramide orogeny, *Geosphere*, 7, 183-201, 2011.
9. Zhang, N. and S.J. Zhong, Heat fluxes at the Earth's surface and core-mantle boundary since Pangea formation and their implications for the geomagnetic superchrons, *Earth Planet. Sci. Lett*., 306, 205-216, 2011.
10. Tan, E., W. Leng, S.J. Zhong, and M. Gurnis, On the location of plumes and lateral movement of thermo-chemical structures with high bulk modulus in the 3-D compressible mantle, *Geochem. Geophys. Geosyst*., 12, Q07005, doi:10.1029/2011GC003665, 2011.
11. Leng, W. and S.J. Zhong, Constraints on viscous dissipation of plate bending from compressible mantle convection, *Earth Planet. Sci. Lett*., 297, 154-164, doi:10.1016/j.epsl.2010.06.016, 2010.
12. Leng, W. and S.J. Zhong, Surface subsidence caused by mantle plumes and volcanic loading in large igneous provinces, *Earth Planet. Sci. Lett*., 291, 207-214, 2010.
13. Zhang, N., S.J. Zhong, W. Leng, and Z.X. Li, A model for the evolution of the Earth's mantle structure since the Early Paleozoic, *J. Geophys. Res*., 115, B06401, doi:10.1029/2009JB006896, 2010.
14. Ghosh, A., T.W. Becker, and S.J. Zhong, Effects of lateral viscosity variations on the geoid, *Geophys. Res. Lett*., L01301, doi:10.1029/2009GL040426, 2010.
15. Lassak, T.M., A.K. McNamara, E.J. Garnero, and S.J. Zhong, Core-mantle boundary topography as a possible constraint on lower mantle chemistry and dynamics, *Earth Planet. Sci. Lett*., 289, 232-241, doi:10.1016/j.epsl.2009.11.012, 2010.
16. Li, Z.X. and S.J. Zhong, Supercontinent-superplume coupling, true polar wander and plume mobility: plate dominance in whole-mantle tectonics? Phys. Earth Planet. Int., doi:10.1016/j.pepi.2009.05.004 , 2009.
17. Zhang, N., S.J. Zhong, and A. K. McNamara, Supercontinent formation from stochastic collision and mantle convection models, Gondwana Research, 15, 267-275, doi:10.1016/j.gr.2008.10.002, 2009.
18. Zhong, S. J., A.K. McNamara, E. Tan, L. Moresi, and M. Gurnis, A benchmark study on mantle convection in a 3-D spherical shell using CitcomS, *Geochem. Geophys. Geosyst.*, 9, Q10017, doi:10.1029/2008GC002048, 2008.
19. Leng, W., and S. J. Zhong, Controls on plume heat flux and plume excess temperature*, J. Geophys. Res*., 113, B04408, doi:10.1029/2007JB005155, 2008.
20. Leng, W., and S. J. Zhong, Viscous heating and adiabatic heating in compressible mantle convection, *Geophys. J. Int*., 173, 693-702, 2008.
21. Zhong, S. J., N. Zhang, Z.X. Li, and J.H. Roberts, Supercontinent cycles, true polar wander, and very long-wavelength mantle convection, *Earth Planet. Sci. Lett*., 261, 551-564, 2007.
22. Paulson, A., S. J. Zhong, and J. Wahr, Inference of mantle viscosity from GRACE and relative sea level data, *Geophys. J. Int*., 171, 497-508, 2007.
23. Zhong, S. J., M. Ritzwoller, N. Shapiro, W. Landuyt, J. Huang, P. Wessel, Bathymetry of the Pacific Plate and its implications for thermal evolution of lithosphere and mantle dynamics, *J. Geophys. Res*., 112, B06412, doi:10.1029/2006JB004628, 2007.

24. Paulson, A., S. J. Zhong, and J. Wahr, Limitations on the inversion for mantle viscosity from post-glacial rebound, *Geophys. J. Int*., 168, 1195-1209, 2007.
25. Zhong, S. J., Constraints on thermochemical convection of the mantle from plume heat flux, plume excess temperature and upper mantle temperature, *J. Geophys. Res*., 111, B04409, doi:10.1029/2005JB003972, 2006.
26. van Hunen, J., S. J. Zhong, N. M. Shapiro, M.H. Ritzwoller, New evidence for dislocation creep from 3-D geodynamic modeling the Pacific upper mantle structure, *Earth Planet. Sci. Lett*., 238, 146-155, 2005.
27. Paulson, A., S. J. Zhong, and J. Wahr, Modeling post-glacial rebound with lateral viscosity variations, *Geophys. J. Int*., 163, 357-371, 2005.
28. Huang, J. S., and S. J. Zhong, Sublithospheric small-scale convection and its implications for residual topography at old ocean basins and the plate model, *J. Geophys. Res*., 110, B05404, 10.1029/2004JB003153, 2005.
29. Ritzwoller, M.H., N.M. Shapiro, and S. J. Zhong, Cooling history of the Pacific lithosphere, *Earth Planet. Sci. Lett.*, 226, 69-84, 2004.
30. McNamara, A. K., and S. J. Zhong, Thermochemical structures within a spherical mantle: Superplumes or piles? *J. Geophys. Res*., 109, B07402, doi:10.1029/2003JB002847, 2004.
31. Podolefsky, N.S., S. J. Zhong, and A. K. McNamara, The anisotropic and rheological structure of the oceanic upper mantle from a simple model of plate shear, *Geophys. J. Int*., 158, 287-296, 2004.
32. Zhong, S. J., A. Paulson, and J. Wahr, Three-dimensional Finite Element Modeling of Earth's Viscoelastic Deformation: Effects of Lateral Variations in Lithospheric Thickness, *Geophys. J. Int*., 155, 679-695, 2003.
33. van Hunen J., J. S. Huang, and S.J. Zhong, The effect of shearing on onset and vigor of small-scale convection with a Newtonian rheology, *Geophys. Res. Lett*., 30, 1991, 10.1029/2003GL018101, 2003.
34. Huang, J. S., S. J. Zhong, and J. van Hunen, Controls on sub-lithospheric small-scale convection, *J. Geophys. Res*., 108, doi:10.1029/2003JB002456, 2003.
35. Zhong, S. J. and B. H. Hager, Entrainment of a dense layer by thermal plumes, *Geophys. J. Int*., 154, 666-676, 2003.
36. Zhong, S. J. and A. B. Watts, Constraints on the dynamics of mantle plumes from uplift of Hawaiian islands, *Earth Planet. Sci. Lett*., 203, 105-116, 2002.
37. Zhong, S. J., Role of ocean-continent contrast and continental keels on Plate motion, net rotation of lithosphere and the geoid, *J. Geophys. Res*., 106, 703-712, 2001.
38. Watts, A. B. and S. J. Zhong, Observations of flexure and the rheology of the oceanic lithosphere, *Geophys. J. Int*., 142, 855-875, 2000.
39. Zhong, S. J., and G. F. Davies, Effects of plate and slab viscosities on geoid, *Earth Planet. Sci. Lett*., 170, 487-496, 1999.
40. Zhong, S. J., M. Gurnis, and L. Moresi, The role of faults, nonlinear rheology, and viscosity structure in generating plates from instantaneous mantle flow models, *J. Geophys. Res.*, 103, 15255-15268, 1998.
41. Zhong, S. J., and M. Gurnis, Incorporation of fault-bound plates in three-dimensional models of mantle flow, *Nature*, 383, 245-247, 1996.
42. Zhong, S. J., and M. Gurnis, Mantle convection with plates and mobile, faulted plate margins, *Science*, 267, 838-843, 1995.
43. Zhong, S. J., and M. Gurnis, The role of plates and temperature-dependent viscosity in phase change dynamics, *J. Geophys. Res*., 99, 15903-15917, 1994.
44. Zhong, S. J., and M. Gurnis, Controls on trench topography from dynamic models of subducted slabs, *J. Geophys. Res*., 99, 15683-15695, 1994.
45. Zhong, S. J., and M. Gurnis, Dynamic feedback between an non-subducting raft and thermal convection, *J. Geophys. Res*., 98,12219-12232, 1993.

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Employment and education

2014– Associate Professor and Murray Pyke Chair, Department of Geological Sciences, Univ. Saskatchewan, Saskatoon, SK, Canada
Research and teaching in global tectonics, long-term trends in Earth's evolution and in hard-rock geochemistry.

2002–14 Manager of the Saskatchewan Isotope Laboratory, Univ. Saskatchewan, Saskatoon, SK. Adjunct Prof. in Dept. Geological Sciences, Univ. Saskatchewan.

2001–02 Unit Head, Laboratory Facility, Council for Geoscience, Pretoria, South Africa and senior isotope geochemist for the organization.

1996–01 Senior isotope geochemist and geochronologist, Council for Geoscience, Pretoria, South Africa.

1992–96 Programme Manager and senior isotope geochemist, Division of Earth, Marine and Atmospheric Science and Technology, CSIR, Pretoria, South Africa.

1982–92 Researcher, National Physical Research Laboratory, CSIR, Pretoria, South Africa. *Geochronology, isotope geochemistry, rock geochemistry and geological mapping in southern Africa.*

1981–87 University of Natal, Durban, South Africa; Ph.D. in Precambrian Geology

1980–80 University of Natal, Durban, South Africa; B.Sc. (Hons.) in Geology

1977–79 University of Natal, Durban, South Africa; B.Sc. in Geology and Applied Geology

Principal research interests and experience:

Development of global database systems to facilitate the reconstruction of supercontinents through Earth history, primarily using geochronology, isotope geochemistry, ore deposits, dyke swarms and regional geology. Regional understanding of Precambrian orogenic belts with a specific interest in the Palaeo- and Meso-proterozoic.

Professional activities:

2000– Associate Editor, *South African Journal of Geology*

2008–12 Associate Editor, *Economic Geology*

2009–10 Chairman, Isotope Chemistry Division, Geol. Assoc. Canada

2006–09 Member, Isotope Chemistry Division, Geol. Assoc. Canada

2002– Member, Geological Association of Canada

2005–10 Database manager and database systems designer/developer of UNESCO International Geoscience Program (IGCP) Project 509, "Palaeoproterozoic Supercontinents and Global Evolution"

1982– Member, Geological Society of South Africa

Selected, relevant publications:

1. Pehrsson, S., Eglington, B.M., Evans, D.A.D., Huston, D. & Reddy, S.M., in revision. Metallogeny and its link to orogenic style during the Nuna supercontinent cycle. *Geological Society of London Special Publication*.
2. Huston, D.L., Eglington, B.M., Leach, D.L.and Pehrsson, S.J. (in review) The metallogeny of zinc through time: links to secular changes in the atmosphere, hydrosphere, and the supercontinent cycle. *Geological Society of London Special Publication*.
3. Pehrsson, S.J., Buchan, K.L., Eglington, B.M., Berman, R.M. and Rainbird, R.H. (in review) Did plate tectonics shutdown in the Paleoproterozoic? A view from the Siderian geologic record. *Lithos*
4. Eglington, B.M., Pehrsson, S., Ansdell, K.M., Lescuyer, J-L., Quirt, D., Milesi, J-P. and P. Brown. (2013). A domain-based digital summary of the evolution of the Palaeoproterozoic of North America and Greenland and associated unconformity-related uranium mineralisation. *Precambrian Research*, 232, 4-26.
5. Pehrsson, S.J., Berman, R.G., Eglington, B.M. and Rainbird, R. (2013) Two Neoarchean supercontinents revisited: the case for a Rae family of cratons. *Precambrian Research*, 232, 27-43.
6. Maxeiner , R.O., Rayner, N.M. and Eglington, B.M. (2012). U-Pb and Sm-Nd isotopic results from the La Ronge Horseshoe project area, western Glennie Domain and southern Rottenstone Domain: evidence for 2.22 to 2.52 Ga detritus. Summary of Investigations 2012, volume 2, Saskatchewan Geological Survey, Saskatchewan Industry and Resources, *Miscellaneous Report* 2012-2,CD-ROM.
7. Eglington,B.M., Thomas,R.J. and Armstrong,R.A. (2010). U-Pb Shrimp Zircon Dating of Mesoproterozoic Magmatic Rocks from the Scottburgh Area, Central Mzumbe Terrane, Kwazulu-Natal, South Africa. *S. Afr. J. Geol.*, 113, 229-235.
8. Huston,D.L., Pehrsson,S.J., Eglington,B.M. and Zaw,K. (2010). The geology and metallogeny of volcanic-hosted massive sulfide deposits: variations through geologic time and with tectonic setting. *Econ. Geol.*, 105, 571-591.
9. Eglington, B.M., Reddy, S.M. and Evans, D.A.D. (2009) The IGCP 509 database system: design and application of a tool to capture and illustrate litho- and chrono-stratigraphic information for Palaeoproterozoic tectonic domains, large igneous provinces and ore deposits; with examples from southern Africa, 27-47. In, Reddy, S.M., Mazumder, R., Evans, D.A.D. and Collins, A.S. (eds.), Palaeoproterozoic supercontinents and global evolution, *Spec. Publ. Geol. Soc. London*, 323, 362pp.
10. Bekker, A., Beukes, N.J., Holmden, C.H., Kenig, F., Eglington, B.M. and Patterson, W.P. (2008) Fractionation between inorganic and organic carbon during the Lomagundi (2.22-2.1 Ga) carbon isotope excursion. *Earth Planet. Sci. Lett.*, 271, 278-291.
11. Eglington, B.M. (2008). Cyclicity in earth evolution constrained by time-series analysis of global igneous activity. *Geochimica Cosmochimica Acta*, 72, Supp. 1, A239.
12. Maier, W.D., Barnes, S-J., Chinyepi, G., Setshedi, I., Barton, J.M. and Eglington, B.M. (2008) The composition of magmatic Ni–Cu–(PGE) sulfide deposits in the Tati and Selebi-Phikwe belts of eastern Botswana. *Mineralium Deposita*, 43, 37-60.
13. Eglington, B.M. (2006) Evolution of the Namaqua-Natal Belt, southern Africa – a geochronological and isotope geochemical review. *J. Afr. Earth Sci.*, 46, 93-111.
14. Eglington B.M. and Armstrong R.A. (2004). The Kaapvaal Craton and adjacent orogens, southern Africa: a geochronological database and overview of the geological development of the craton. *S. Afr. J. Geol.*, 107, 23-32.
15. Eglington B.M. (2004). DateView: a Windows geochronology database.

Computers and Geosciences, 30, 547-558
16. Eglington,B.M. and Armstrong,R.A. (2003). Geochronological and isotopic constraints on the Mesoproterozoic Namaqua-Natal Belt: evidence from deep borehole intersections in South Africa. *Precambr. Res.*, 125, 179-189.
17. Eglington,B.M., Thomas,R.J., Armstrong,R.A. and Walraven,F. (2003). Zircon geochronology of the Oribi Gorge Suite, KwaZulu-Natal, South Africa: constraints on the timing of trans-current shearing in the Namaqua-Natal Belt. *Precambr. Res.*, 123, 29-46.
18. Grantham,G.H., Maboko,M.A.H., and Eglington,B.M. (2003). A review of the evolution of the Mozambique Belt and implications for the amalgamation and dispersal of Rodinia and Gondwana, 401-425. In, Yoshida, M., Windley, B. F., and Dasgupta, S. (eds.), Proterozoic East Gondwana: supercontinent assembly and breakup, *Spec. Publ. Geol. Soc. London*, Vol. 206.
19. Thomas,R.J., Chevallier,L.C., Gresse,P.G., Harmer,R.E., Eglington,B.M., Armstrong,R.A., De Beer,C.H., Martini,J.E.J., De Kock,G.S., Macey,P. and Ingram,B. (2003). Precambrian evolution of the Sirwa Window, Anti-Atlas orogen, Morocco. *Precambr. Res.*, 118, 1-57.
20. Grantham,G.H., Eglington,B.M., Thomas,R.J. and Mendonidis,P. (2001). The nature of the Grenville-age charnockitic A-type magmatism from Natal, Namaqua and Maud Belts of southern Africa and western Dronning Maud Land, Antarctica. *Memoir National Institute for Polar Research*, 55, 59-87.
21. De Kock,G.S., Eglington,B.M., Armstrong,R.A., Harmer,R.E. and Walraven,F. (2000). U-Pb and Pb-Pb ages on the Naauwpoort rhyolite, Kawakeup leptite and Okongava diorite: implications for the onset of rifting and of orogenesis in the Damara Belt, Namibia. *Communs geol. Surv. Namibia.*, 12, 81-88
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