INTERNATIONAL GEOSCIENCE PROGRAMME (IGCP)

Annual Report* of IGCP Project No. 493 (2006)

*The information in this report will also be used for publication in 'Geological Correlation' (please feel free to attach any additional information you may consider relevant to the assessment of your project).

IGCP project short title: The Rise and Fall of the Vendian (Ediacaran) Biota

Duration: 2003-2007

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1. **Website address:** http://www.earth.monash.edu.au/PreCsite/index.html

2. **Summary of major past achievements of Project 493:**

a. Workshop coincident with the International Geological Congress, Florence 2004. IGCP493 meeting in Prato held at the Prato Centre, Monash University. Publication of Papers from this Conference invited by the Geological Society of London as a Special Paper, submitted in December 2006, publication date, 2007**.**

b. As part of the North American Paleontological Convention held at Dalhousie University, Halifax Nova, Scotia from 19-26 June 2005, IGCP 493 and the Ediacaran Subcommission hosted a **symposium** entitled: *Ediacaran paleobiology: paleontological, molecular, embryological, and ecological constraints.* An **excursion** entitled: *Life After Snowball: The Mistaken Point Biota and the Cambrian of Avalon*, conducted by Guy Narbonne, Jim Gehling and Marc La Flamme on the Avalon Peninsula of southeastern Newfoundland from June 13-19th, 2005, with 30 participants. The field trip enabled participants to study the latest fossil discoveries in the Ediacaran succession.

c. A series of **field workshops** have been held in Namibia, Argentina, Australia, Russia and members have attended and participated in symposia and field workshops with IGCP 478 and IGCP512 in Namibia and China.

d. **Public outreach projects** include as stamp issue with Australia Post initiated and directed by leaders of IGCP493 (*Creature of the Slime*, launched at the Pacific Explorer 2005 World Stamp Expo in Sydney, Australia on 22 April 2005), a joint childrens' book publication with Australia Post and a teachers' kit developed to accompany the stamp release, developed in conjunction with the Monash Science Centre in Melbourne. The construction of two exhibitions (one at the South Australian Museum and another at Monash University in Melbourne) on Neoproterozoic metazoans during 2005

e. **Definition of the Ediacaran Period** and recognition of a global GSSP for the base of the Ediacaran in the Flinders Ranges of South Australia.

f. Work towards setting aside areas that have produced prime Ediacaran/Vendian assemblages as **heritage sites**, protected and yet available for ecotourism, particularly in the Flinders Ranges of South Australia and the Aus region of Namibia. Assistance in Namibia to set up a small regional museum on a rural property which has produced significant Ediacaran fossil assemblage, to assist in conserving these sites and encouraging limited ecotourism that will itself help fund the locals to protect important scientific sites.

g. **Publication** of a significant number of **research papers, monographs, proceedings volumes** that spotlight the earliest metazoans as well as the environments that came before and nurtured them. Examples include Narbonne (2005), Grey (2005) and Vickers-Rich & Komarower (eds) (in press).

Grey, K., 2005. Ediacaran Palynology of Australia. *Memoirs of the Association of Australasian Palaeontologists*, 31: 1-439.

This monograph on the palynology of the newly defined Ediacaran System is the culmination of a major project to correlate terminal Neoproterozoic rocks began by Kath Gray as her PhD in 1991. It wil be a key rreference tool for both petroleum and mineral exploration in the older rocks across Australia. This study paved the way for a parallel study of Cryogenian biostratigraphy in the western Officer Basin of Australia, based largely on the Geological Survey of Western Australia onshore basins drilling program. Both stromatolites and palynology show consistent result across the basin, match results from stable isotope chemostratigraphy, and allow correlation with units of similar age elsewhere in Australia. This revised lithostratigraphy of the Officer Basin for Lancer drillhole 1 were also published this year.

Narbonne, G. M., 2005. The Ediacara Biota: Neoproterozoic origin of animals and their ecosystems. *Annual Review of Earth and Planetary Sciences*, 33: 421-442.

h. **Publication of popular literature and presentation of public symposia.** *The Rise of Animals. Evolution and Diversification of the Kingdom Animalia* by Fedonkin, Gehling, Grey, Narbonne and Vickers-Rich has been a major project of IGCP493 from 2003 and was submitted in December 2006. Publications such as that by Andrew Plant *Creatures of the Slime* issued by Australia Post is an initiative of IGCP493 as is the teacher`s guide to the Ediacara stamps also issued by AP and prepared by staff at the Monash Science Centre. Public symposia such as that offered by Gehling, Vickers-Rich and Fedonkin at the New South Wales Teachers Conference in 2003 are examples of continued public outreach. The **in the classroom lessons** offered by many members of IGCP493, such as Terufumi Ohno at the Kyoto University Museum in Japan are other forms of public outreach and education – bringing front line science to the public. Along with these activities, and for fun as well as fundraising, a series of commercial jewellery depicting Ediacarans as well as one CD of music in memory of Ediacarans was developed to raise public profile.

See TAG reports on website for more detail and refer to annual reports for 2003 through 2005.

3. Achievements of the project this year

3.1. Countries involved in this project (all active in 2006):

Argentina
Australia
Brasil
Canada
Peoples Republic of China
Germany
India
Iran
Iraq
Ireland
Italy
Japan
Namibia
New Zealand
The Netherlands
Poland
Russia
Scotland
Spain
Scotland
South Africa
Sweden
Taiwan (Republic of China)
United Kingdom
United States
Uruguay

3. Achievements of the project this year

3.2. General scientific achievements (including societal benefits)

- Guy Narbonne and collegues have continued to work with the Canadian Government to list the Mistaken Point Ecological Reserve as a place of Natural Heritage for its Ediacara

fossils. As a consequence, an **interpretive center** is being built at Portugal Cove South on the Avalon Peninsula to promote ecotourism and the protection of the fossil locales.

- The $60,000 **Tourism and Conservation Partnerships Initiative Grant** that was awarded 2005 and continuing to the custodians of Ediacara fossil sites in the Flinders Ranges in South Australia in conjunction with the South Australian Museum is being implemented for the feasibility study of tourist participation and visitation allied with fossil excavations.

- The $68,000 **Federal Visions Grant** (Australia) awarded to Monash University for the preparation of an Exhibition entitled *Wildlife of Gondwana* is now being implemented and will spotlight the Ediacaran fauna, bringing cutting edge research results to the public and school children. This exhibition asks people to consider climatic and biotic change of the past and use it as a gauge when making decisions about the future. Its first venue will be in Taichung, Republic of China, opening there in May 2007. After that it will return to Australia and tour for at least 2-3 years.

- Construction and launch of a **traveling exhibition** (***Before the Dinosaurs – the First Animals on Earth***), which premiered at the Fukui Prefectural Museum in Japan in mid-July 2006 accompanied by a full colour, 84 page catalogue (sample provided separately) along with commercial products that generated research funds (earrings, tie pins) and educational kits. More than 90,000 people attended this exhibition over 3 months and it will travel for another year before material is due to be returned to original collections. Australian and Japanese citizens provided graphic art pieces, soft models, specially produced tapestries to celebrate the opening of the exhibition, which were then included as permanent parts of this public exhibition. The exhibitions was recognized by the Australian Government as an official project of the YOE (Year of Exchange between Japan and Australia – 2006). Qantas Airways provided significant assistance in the transport of the exhibition and was recognized as the principal sponsor. The exhibition generated significant funds for research and construction of the exhibition.

3.3. <u>List of meetings with approximate attendance and number of countries</u>

a. **Scientific Symposium** entitled: *The Elusive Ediacarans. Where did they come from and Where did they go?* Two day symposium (30-31 January) held at the Kyoto University Museum, with a pre-symposium field excursion to the Seto Marine Laboratories south of Osaka (28-29 January). Twenty-five participants took part with 10 symposium papers being presented. <u>Countries represented</u>: Japan, Taiwan, the United States, Australia and Sweden, with representatives from many universities and museums in Japan dominant. Papers from this symposium were rapidly submitted, reviewed, edited and included in the Special Paper volume of the Geological Society of London, along with the papers from the Prato 2004 Symposium contributions, now in press. (23 official attendees, though at times additional graduate students and public attended certain presentations).

b. **Two Public Symposia** were held at the Kyoto University Museum, one in mid-January (14-15 January) and a second presented on the 27th of January just prior to the IGCP493 scientific meeting. More than 50 participants attended each of these symposia and the topic for both was Science Communication – communication of high level, in depth science to the public and pre-Tertiary students. Participants included a wide range of ages, talks were given in English with simultaneous translation, and two workshops were conducted covering topics related to Neoproterozoic metazoans. Two keynote addresses were presented and Attendees were primarily from Japan. Keynote speakers included Prof. Jim Valentine (University of California, Berkeley), Prof. Patricia Vickers-Rich (Australia), Prof. Terifumi Ohno (Japan), all participants in IGCP493. <u>Countries represented</u>: Japan, Australia, United States, Sweden, Taiwan. Each symposium hosted approximately 50-60 attendees).

A third public symposium was held at the Fukui Prefectural Dinosaur Museum in mid-July with more than 100 attendees. This was run coincident with the opening of the ***Before the Dinosaurs. The First Animals on Earth*** exhibition as part of its opening ceremonies. <u>Countries represented</u>: Attendees were mainly from Japan, but some foreign tourists were

in the audience from the United States, Canada, China, Russia and Australia. Symposium hosted approximately 100.

c. **Field excursion** to anoxic lake, Kamikoshiki Island, Japan (19-21 January)

d. **Field Workshop**, Aar Region, Southern Namibia (8-25 October)

e. **Field Workshop,** Marwar SuperGroup of Neoproterozoic age of Rajasthan, Western India, and the Buxa Dolomite of Meso-Neoproterozoic age near Ganggtok, Sikkim, Eastern Himalaya carried out in August by the Indian Natinal Working Group.

f. The Australian Broadcasting Commission (ABC) produced a ***Catalyst*** program feature on the Ediacaran biota from the Flinders Ranges of South Australia featuring members of IGCP493 (Jim Gehling and Richard Jenkins) on 9 November.

g. From India, Mr. V. K. Mathur, Geological Survey of India, recovered microfossils resembling larvae & eggs from the Chambgha Formation of the Krol Group, Himachal Pradesh Lesser Himalaya. This horizon is correlative to that of the Doushantuo of China from where similar fossils have been reported.

h. Many participants in IGCP493 regularly present invited keynote addresses, public lectures, etc. The presentations of Prof. Guy Narbonne, Nikolay Chumakov and V. C. Tewari are given as exemplary:

Guy Narbonne invited seminars on Ediacarans 2006:

Australia Centre for Astrobiology
Macquarie University, Australia
University of New Brunswick
Dalhousie University
St. Mary's University
St. Francis Xavier University
Acadia University
Memorial University of Newfoundland
Williams College, MA (Sperry "Five Colleges" Distinguished Lecturer)
Canadian Science Writers Association Keynote Speaker, St. John's

Nikolay Chumakov lectures on Ediacaran climate 2006

School of Young Paleontologists, Paleontological Institute of the Russian Academy of Sciences, Moscow ("Climate and the Bioshpere and (*Ancient Cimates and Paleomagnetism*)
Department of Geography Lecture Series, Moscow State University (*Climates and Biospheres of the Past*)

V. C. Tewari public keynote address at the National Seminar on Precambrian Life: Indian Scenario, Department of Geology, Durgapur government College, Durgapur, West Bengal on 23 August 2006
(Origin and Evolution of Life and Its Evidence from India: Meteorites to Stromatolites).

See also reports for IGCP478, 512 and that of the Internatinal Commission on Stratigraphy, Subcommission on Ediacaran and Cryogenian Stratigraphy for reports on conferences and meetings where IGCP493 had a presence: The Neoproterozoic field workshop coincident with the 2nd International Palaeontological Congress in China (June 6-16), and the Ediacaran and Cryogenian Subcommission symposium and poster session on Neoproterozoic Palaeontology and Geobiology (Beijing, June 17-21); the Acraman Workshop organized by the Australian Centre for Astrobiology at Macquaire University (August-9); the "Snowball Earth 2006 Conference (16-21 July), Ascona, Switzerland.

3.4. ***Educational, training or capacity building activities***.

- Malgorzata Mocaydlowska-Vidal continues to fund one research of student, Sebastian Willman (Origins of Neoproterozoic-Early Palaeozoic phytoplankton), with a grant from the Swedish Resarch Council for 2005-2007 for project "Neoproterozoic microbial diversification – a prelude to the Phanenerozoic world."

- Mikhail Fedonkin partly funds two graduate students, Maxim Leonov and Ekaterina Serezhnikova, from grants of the Russian Government Fund for Basic Research. These two students were provided bursaries this year to spend nearly 3 weeks in Australia in order to visit the Flinders Ranges and study collections at the South Australian Museum, Adelaide. A senior researcher, Dr Andrey Ivantsov from the Paleontological Institute was also able to participate, fully funded by a bursary as well.

- Jim Gehling and Kath Grey have hosted a number of international students to carry out research on the Ediacara fauna and microfossils from Australia.

- Monash University continues to host an artist in residence (Peter Trusler) funded by grants and private donations to "illustrate" the Ediacaran Period. This began in 2004 and will continue into 2007 with the outcome being capacity building of illustrative material available for use in educational, scientific publications and as a point of debate among researchers active in this field. These illustrations will be used in a book entitled: *The Artist and the Scientists* (coauthored by many participants in IGCP493). Trusler has visited four of the major Ediacaran locales – the White Sea, Newfoundland, the Flinders Ranges and Namibia in his data gathering for reconstructions and attended the Acsona conference in Switzerland in 2006 to confer with researchers.

- During 2005 and 2006 cabinets were constructed and information panels were provided to the owners of Farm Aar near the southern Namibian town of Aus to assist in setting up a small local museum. This is being used by a limited number of ecotourists who visit the area and allows some funding for the landowners who are the major guardians of the Ediacaran fossil sites in this area. Together with the Geological Survey of Namibia, proposals to set this area aside as a heritage site are underway.

- Final construction and installation of 50 cabinets for housing of the Vendian collection at the Paleontological Institute of the Russian Academy of Sciences, Moscow and partial funding for the curation and construction of a computer data base for this material (total funding of $35,000, a major part which was provided by the Hunt Family of Nebraska).

3.5. Participation of scientists from developing countries

Currently we have representation and programs in Iraq, Iran, Namibia, Russia, Argentina, the Peoples Republic of China, Taiwan and are currently seeking further participation from countires not currently represented. In 2006 our working group based at the Univesity of Mosul in Iraq was quite active. Dr Nazar Numan continued to supervise Ph.D. students with projects in structural geology and geotectonics and taught significant numbers of students in first (more than 100), and 2nd-4th year (more than 200). Though the record in Iraq begins in the Cambrian, the search for older material is hindered only by the precarious security situation.

At the beginning of 2006 Thomas Rich undertook a preliminary survey in cooperation with the Arabian Geological Survey, to explore Precambrian and Mesozoic and will return with a larger group in January 2007, funded by the Arabian Geological Survey.

With funding provided by the Ediacaran exhibition in Japan, IGCP493 was able to host graduate students and staff from Russia to visit collections in Namibia and Australia and able to provide some funding for further research to staff at the South Australian Museum and the Paleontological Institute, Ruasian Academy of Science, Moscow.

A field workshop with staff at the Geological Survey of Namibia and the landowners of Farm Aar, near Aus, Namibia during the month of October led not only to discovery of outstanding new

material of *Rangea* found in situ in the Kliphoek Mbr of the Nama Group but also to the setting up of a local museum for limited ecotourism and the drawing up of plans for designation in the future of this area as a National Heritage site.

3.6. List of most important publications (including maps)

All papers and books listed are peer-reviewed.

Fedonkin, M. A., Gehling, J. G., Grey, K., Narbonne, G. M. and Vickers-Rich, P., 2006 (in press for release in 2007). ***The Rise of Animals. Evolution and Diversification of the kingdom Animalia.*** Johns Hopkins Press, Washington, 302 pp (with 1477 illustrations, the majority in colour and a comprehensive appendix of all described Ediacaran metazoan taxa).

Vickers-Rich, P. and Komarower, P., 2006 (in press for release in 2007). *The Rise and Fall of the Vendian/Ediacaran Biota*. Geological Society of London, Special Paper (38 papers, and numerous Abstracts [which will be available on the web only] the result of two IGCP Symposia: Prato (2004) and Kyoto (2006)).

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2. Antcliffe, J. B. and Brasier, M. F. Towards a morphospace for the Ediacara biota. *In:* Vickers-Rich P. and P. Komarower (Eds.) "Rise and Fall of the Vendian/Ediacaran Biota", *Geological Society of London, Special Paper* (in press).

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19. Fedonkin M.A. Eukaryotization of the Early Biosphere. V. I. Vernadsky 45th Scientific Lecturing, Institute of Geochemistry and Analytical Chemistry, Russian Academy of Sciences, Moscow (in press) (In Russian).
20. Fedonkin V.A., Gehling J.G., Grey K., Narbonne G.M. and Vickers-Rich P. *The Rise of Animals. Evolution and Diversification of the Kingdom Animalia*. John Hopkins Press (1477 illustrations, mostly colour): 302 pp (in press).
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3.7. Activities involving other IGCP projects or the IUGS

Members and co-leaders of IGCP493 are also members/leaders of other projects and often meetings, workshops and joint projects occur interfaced with these.

IGCP 478 (*Neoproterozoic-early Paleozoic events in SW Gondwana*) led by **Claudio Gaucher, Hartwig Frimmel and Paulo Boggiani.**

IGCP 497 (*The Rheic Ocean: its origin, evolution and correlatives*) led by **Ulf Linnemann.**

IGCP 512 (*Neoproterozoic Ice ages*) led by **Graham Shields** and **Emmanuelle Arnaud**.

ICS Subcommission on Ediacaran and Cryogenian Stratigraphy led by Chairman **James Gehling** with Vice-Chair **Shuhai Xiao** and Secretary **Graham Shields**.

4. Activities planned

4.1. General goals

General goals of IGCP493are to continue to encourage the interaction of a broad range of scientists whose task it is to tease out the relationships of the Ediacaran fauna - are these metazoans closely related to living phyla or are they representatives of "lost" architectures which left no living representatives. They are likely both, and sorting out just which is which and just to whom those stems on the phylogentic tree gave rise to crown groups is a major task of this project. Another goal is attempting to understand the physical and biological aspects of the Earth upon which the ediacarans lived and with whom they interacted, all critical in the development of this unusual and unique biota. Input from research in the areas of geochemistry, tectonics, paleoclimatology and paleogeography, amongst many others, all have bearing on this project – and thus firm interaction with participants in IGCP projects 478, 497 and 512 , as well as the Subcomission on Ediacaran and Cryogenian Stratigraphy is essential.

4.2. Specific meetings and field trips (please indicate participation from developing countries)

- Group interview with Prof. Boris Sokolov in preparation for a book about his life and his contribution to the understanding of the Vendian Biota, Moscow, Russia **(23 January – 5 February, 2007).**
- Meeting with Secondary Students at Notre Dame School in Kyoto to plan development of a joint IGCP493-Notre Dame educational kit on the Ediacaran biota (bilingual) **(6-9 February 2007)**. Visit of this group to Australia **(23-29 March 2007)**
- International Workshop on Ediacaran/Vendian metazoans, the Indian Scenario, Dehra Dun, **late March – Early April 2007 or November 2007**, coordinated by P. C. Basu, Geological Survey of India.
- **Field trip** to the Olenek Uplift, Siberia funded in part by a National Geographic grant to M. A. Fedonkin, August 2007.
- **Symposium** on the Vendian biota with encouraged access to the newly housed and curated Vendian collections at the Paleontological Institute, Russian Academy of Sciences, Moscow **(September, 2007).**
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5. Project funding requested

As per 2006, full funding

6. Request for extension, on-extended-term-status, or intention to propose successor project

In 2008 an on-extended request will be submitted, as this project will need to continue for some time into the future

7. Financial statement

See attached

Significant additional Funding for this Project was secured in 2006:

a. Purchase of Cabinets to house Vendian Collection at the Paleontological Institute, RAS **$US 35,000**

b. Australian IGCP local committee funding for Aust. researchers (Trusler, Vickers-Rich, Rich) **$Aust. 5,000**

c. Private donation for curation of Boris Sokolov library

and curation of Vendian collection, Paleontological Institute, RAS **$US 5,000**

d. Grant for reconstruction art work by Peter Trusler **$Aust. 40,000**

e. Research Initiatives Grant, etc. from Monash University (to Vickers-Rich) **$Aust. 30,000**

f. ARC grant to Gehling, Drosser and Jensen **$Aust. 50,000**

g National Geographic Grant to Fedonkin **$US 11,000**
(for use in 2007)

h. Income from several exhibitions **$Aust. 210,000**

i. Publications grant to P. Vickers Rich from Monash Uni. **$Aust. 5,000**
(for assistance in the publication *The Rise of Animals*)

8. Attach any information you may consider relevant

Previous years' files available on the website and hard copy of catalogues, commercial projects and educational/public outreach material will be sent via air mail for the committee to consider.

Attached with the report are digital files of some of the exhibition panels developed for "outpost museums" in Namibia (Farm Aar) and Australia (Arkaroola) as well as an education kit developed in cooperation with Australia Post and the Monash Science Centre and used in schools around Australia.