



Annual Report* of IGCP Project No. 587

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 IGCP project short title: Identity, Facies and Time –
 The Ediacaran (Vendian) Puzzle

Duration: 2010-2014

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Annual Report**1. Website address(es) related to the project**

<http://monash.edu/science/about/schools/geosciences/prec>

2. Summary of major past achievements of the project

See website, which details each year of project plus the precursor to this project, IGCP493.

3. Achievements of the project this year only

- a. Organized 2 **field conferences** (Brazil, Saudi Arabia)
- b. **Fundraised** more than \$270,000 beyond the seed funding to support field research
- c. **Published significantly**, in particular with a book on Academician Boris S. Sokolov, a highly respected and prolific researcher associated with IGCP587, 493 and still publishing up until his in August 13.
- d. Two major **exhibitions** and several smaller ones were put in place in Singapore in 2013 or will be in early 2014. See 3.2 below.

3.1. List of countries involved in the project

Australia, Russia, Canada, Namibia, Russia, Japan, Iran, Germany, China, Taiwan, USA, India, Singapore, Argentina, Saudi Arabia, Timor-Leste, Brazil, South Africa, United Kingdom.

3.2. General scientific achievements and social benefits

Several research field expeditions were carried out in Saudi Arabia, Canada, South Australia, Russia, and Namibia, with resultant publications, one in particular being the Cover Article in the *Journal of Paleontology*, listed below. Several scientific exhibitions were produced and four launched in 2013, which included concepts developed by members of IGCP587 in rural Victoria (the Cape Otway Light Station) and Melbourne (Monash Gallery of Art), both in Australia, another one in Singapore (Singapore Science Centre) and two others nearly completed, one in Singapore at the ArtScience Museum and another in Adelaide at the South Australian Museum. Children's books and several short documentaries were also published or produced that included the outcomes of research carried out by IGCP587 participants. See detail below.

3.3. List of meetings with approximate attendance and number of countries

- a. Corumba Meeting 2013. The Neoproterozoic Paraguay Fold Belt (Brazil): Glaciation, Iron-Manganese Formation and Biota, Campo Grande and Corumba, Mato Grosso do Sul, Brazil 4-9 August 2013, 42+ participants (Brazil, Australia, USA, Uruguay, Germany, China) – a UNESCO-IUGS-ICS Ediacaran Subcommittee joint effort. Hosted by the Geological Survey of Brazil (CPRM), Petrobras, the Brazilian Society of Geology – Brasilia and Vetrica Mineracao, and the Universidade de Brasilia.
- b. Neoproterozoic of the Northwestern Arabian Shield, 2013. 3-14 March 2013. 14 participants. Saudi Arabia, Russia, Australia, UK. Hosted by the Saudi Geological Survey, the Paleontological Institute, Russian Academy of Sciences and Monash University.

3.4. Educational, training or capacity building activities

IGCP587 continued to travel the *Wildlife of Gondwana Exhibition* to regional Australia (Townsville, Qld; Eastern Suburbs of Melbourne, KIOSC in Wantirna) and to Singapore at the end of 2013. Another series of exhibitions on the geology of Timor-Leste (*O Mundo Perdido Timor-*

Leste), with a component on the late Neoproterozoic continued to thrive in the capital Dili at the Offices of the President as did two in the regional towns of Aileu and Baucau. All of these exhibitions are accompanied by education modules that are suited to the country and culture where the exhibitions are on show. Four more translations (Arabic, Baikeno and Fataluku (mother tongues in Timor) and Hebrew) were published on the geology of Timor-Leste [*O Mundo Perdido Timor-Leste*], written by the President of the country/Nobel Prize recipient Dr Jose Ramos-Horta and Patricia Vickers-Rich. The book is now in 19 languages and counting.

3.5. *Participation of scientists from developing countries, and in particular young and women scientists*

Activities continuing in such countries as Namibia, Iran, Saudi Arabia, Brazil (a BRIC country), and India has offered opportunities for participation of young researchers, both women and men, to work closely with established and productive senior researchers. It has also provided the long term mentoring even at a distance after the contact during meetings and field research trips. Funding from IGCP along with grants that were gained due to the IGCP relationship have assisted in these ongoing relationships.

3.6. *List of most important publications (including maps)*

All are peer reviewed, but only a selection:

Chen, Z., C. Zhou, M. Meyer, K. Xiang, J. D. Schiffbauer, X. Yuan, and S. Xiao, 2013, Trace fossil evidence for Ediacaran bilaterian animals with complex behaviours. *Precambrian Research*, 224: 690-701.

Chirivella Martorell, J.B., Gozalo, R., Dies Álvarez, M.E. y Liñán, E. 2013. *Bailiella* cf. *tenuicincta* (Linnarsson, 1879), una fauna escandinava en el Cámbrico medio de las Cadenas Ibéricas (NE de España). *In: Álvarez-Vázquez & López Rodríguez, I. (eds.). XXIX Jornadas Españolas de Paleontología. La Paleontología del Paleozoico.* Córdoba, Spain: 73-74.

Chumakov, N. M., Semikhatov, M. A., and Sergeev, V. N., 2013. Vendian reference section of southern Middle Siberia. *Stratigraphy and Geological Correlation*, 21 (4): 359-382.

Hall, M., Kaufman, A. J., Vickers-Rich, P., Ivantsov, A., Trusler, P., Linnemann, U., Hofmann, M., Elliott, D., Cui, H., Fedonkin, M., Hoffmann, K.-H., Schneider, G. & Smith, J., 2013. Stratigraphy, Palaeontology and Geochemistry of the late Neoproterozoic Aar Member, southwest Namibia; Reflecting environmental controls on Ediacara fossil preservation during the terminal Proterozoic in African Gondwana. *Precambrian Research*, 238: 214-232.

Mason, S.J., Narbonne, G.M., Dalrymple, R.W., and O'Brien, S.J. 2013. Paleoenvironmental analysis of Ediacaran strata in the Catalina Dome, Bonavista Peninsula, Newfoundland. *Canadian Journal of Earth Sciences*, 50: 197–212.

Macdonald, F.A., Strauss, J.V., Sperling, E.A., Halverson, G.P., Narbonne, G.M., Johnston, D.T., Kunzman, M., Petach, T., Schrag, D.T., and Higgins, J.A., 2013, The stratigraphic relationship between the Shuram carbon isotope excursion, the oxygenation of Neoproterozoic oceans, and the first appearance of the Ediacara biota and bilaterian trace fossils in northwestern Canada, *Chemical Geology*, <http://dx.doi.org/10.1016/j.chemgeo.2013.05.032>

Nettle, D., Halverson, G.P., M. Grant, M Cox, Collins, A.S., Schmitz, M., Gehling, J.G., Johnson, P.R., and Kadi, K. 2013. A middle–late Ediacaran volcano-sedimentary record from the eastern Arabian-Nubian shield. *Terra Nova*, in press.

Pang, K., Q. Tang, J. D. Schiffbauer, J. Yao, X. Yuan, B. Wan, L. Chen, Z. Ou, and S. Xiao, 2013. The nature and origin of nucleus-like intracellular inclusions in Paleoproterozoic eukaryote microfossils. *Geobiology*, 11: 499-510.

Serezhnikova E.A., 2013. Attachments of Vendian Fossils: Preservation, morphology, morphotypes, and possible morphogenesis. *Paleontological Journal*, 47 (3): 231–243.

Tang, Q., K. Pang, S. Xiao, X. Yuan, Z. Ou, and B. Wan, 2013, Organic-walled microfossils from the early Neoproterozoic Liulaobei Formation in the Huainan region of North China and their biostratigraphic significance. *Precambrian Research*, 236: 157-181.

Vickers-Rich, P. with B. S. Sokolov, 2013. *The Flight: Boris S. Sokolov. Natural History and Paleontology in the Changing Landscape of 20th and 21st Century Russia*. The Palaeontological Society of India, Lucknow: 262 pp + appendix on disc.

Vickers-Rich, P., Ivantsov, A. Yu., Trusler, P. W., Narbonne, G. M., Hall, M., Wilson. S. A., Greentree, C., Fedonkin, M. A., Elliott, D. A., Hoffmann, K. H. & Schneider, G. I. C., 2013 (cover article). Reconstructing Ranges: New Discoveries from the Ediacaran of Southern Namibia. *Journal of Paleontology*, 87 (1):1-15.

Vickers-Rich, P. Ivantsov, A., Kattan, F. H., Johnson, P. R., Qubsani, A. Al., Kashghari, W., Leonov, M., Rich, T., Linnemann, U., Hofmann, M., Trusler, P., Smith, J., Yazedi, A. Rich, B., Garni, S. M. A., Shamari, A., Barakati, A. And Kaff, M. H. A., 2013. In search of the Kingdom's Ediacarans: The first genuine metazoans (macroscopic body and trace fossils) from the Neoproterozoic Jibalah Group (Vendian/Ediacaran) on the Arabian Shield. *Saudi Geological Survey, Technical Report*, SGS TR-2013-5: 1-21.3.7.

Xiao, S., M. Droser, J. G. Gehling, I. V. Hughes, B. Wan, Z. Chen, and X. Yuan, 2013. Affirming life aquatic for the Ediacara biota in China and Australia. *Geology*, 41: 1095-1098. Yuan, X., Z. Chen, S. Xiao, B. Wan, C. Guan, W. Wang, C. Zhou, and H. Hua, 2013, The Lantian biota: A new window onto the origin and early evolution of multicellular organisms. *Chinese Science Bulletin (English Edition)*, 58: 701-707.

Xiao, S., Droser, M.L., Gehling, J.G., Hughes, I.V, Wan, B., Chen, Z. and Yuan, X., 2013. Affirming life aquatic for the Ediacara biota in China and Australia. *Geology* **41**, 1095-1098, doi:10.1130/G34691.1.

Xiao, S. and Knauth, L. P., 2013, Fossils come in to land. *Nature*, 493: 28-29.

Yuan, X., Z. Chen, S. Xiao, B. Wan, C. Guan, W. Wang, C. Zhou, and H. Hua, 2013. The Lantian biota: A new window onto the origin and early evolution of multicellular organisms. *Chinese Science Bulletin (English Edition)*, 58: 701-707.

3.7 Activities involving other IGCP projects, UNESCO, IUGS or others

Many other organizations were involved with the activities of IGCP587 in 2013, some of which included: International Commission on Stratigraphy/Subcommission on Ediacaran Stratigraphy (ICS) along with IUGS, Nucleo Brasilia, UFMS, Vetria Mineracao, Petrobras, CPRM (Servico Geologico do Brasil), Universidade de Brasilia, Ministerio de Minas e Energia, the Saudi Geological Survey, the Namibian Geological Survey, Museum Victoria, Universidad Federal do Mato Grosso do Sul, INSUEGO at Universidad de Tucuman, Museo Paleontologico Egidio Feruglio, Geological Survey of Brazil (SPRM), Birbal Sahni Institute of Palaeobotany, the Paleontological Institute of the Russian Academy of Sciences, and many other groups with programs that have interfaced with those in IGCP587. Activities included field and laboratory research, student mentoring, exhibition construction, school curriculum development, etc.

4. Activities planned

4.1. General goals

- a. Continue the detailed examination of each of the major Ediacaran successions – in

2014 the Yangtze Gorges region. Avalon, White Sea and Nama have already been examined with meetings.

- b. Develop a more refined biostratigraphy.
- c. Search for both ancestors and survivors of the “Ediacaran biota” with special emphasis on the sections in Canada, Namibia, Saudi Arabia and Argentina.
- d. Determine what are the true affinities of the Ediacarans.
- e. Gain a better understanding of the drivers for the rise and fall of the Neoproterozoic metazoans – with emphasis on more precise dating and geochemical signals.

4.2. Tentative list of specific meetings and field trips

- a. **Conference in Argentina at IPC2014: Symposium 5. Neoproterozoic palaeobiology: preservation, palaeobiology, environments and phylogeny.** *Organizers:* Jim Gehling, Guy Narbonne. The International Palaeontological Congress (IPC) is a global meeting devoted to Palaeontology throughout the world. It convenes every four years under the aegis of the International Palaeontological Association. Following three previous editions in Sydney (2002), Beijing (2006) and London (2010), it will now take place on an American continent for the first time. The 4th IPC will explore the courses Palaeontology may take as the 21st century ushers in profound and long lasting technological changes. Mendoza, Argentina. <http://www.ipc4mendoza2014.org.ar/> 28 Sept. to 3 Oct. 2014.
- b. **Yangtze Gorges 2014.** A Symposium and Field Workshop on Ediacaran Subdivision and Correlation and Cryogenian Glaciations, Yichang, China, June 11-22, 2014. Organizing Committee Chair: Shuhai Xiao. Secretary: Chuanming Zhou (cmzhou@nigpas.ac.cn)

5. Project funding requested

\$10,000 in particular to underwrite student and early career researchers, with an goal to provide equity, for attendance at two, three field conferences in China, Namibia and Saudi Arabia, and to use these conference, partly supported by the geological surveys in two of the countries as a training ground for young researchers. In 2013 a significant amount of our funding was directed to this same commitment.

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

7. Financial statement (\$ USD only)

See Form III A total of \$13,984.00 US was accounted for. This does not include a significant amount of further funds raised to support travel for students and participants in this project, where the IGCP funds served as seed funds. (see below) – more than \$375,000 plus a significant additional amount in in-kind support.

9. What additional funding besides the IGCP seed funding has your project obtained thanks to the IGCP label?

- a. **\$25,000**, *National Geographic Society* grant for work in Namibia.
- b. **\$200,000** Art Science Museum, Singapore for rental of two exhibitions (*Wildlife of Gondwana* and *The Artist and the Scientists*) that both showcase research carried out under the IGCP587 banner. More than 70% of these funds will support further research by participants in IGCP587.
- c. **\$13,304** provided by the Australian IGCP Committee for participants in IGCP587.
- d. **\$2,500** Explorers Club (New York) grant to student participant in IGCP587.

- e. **\$45,000** from private funds to underwrite field work for both students and more senior research staff associated with the project.
- f. **\$90,000** Inspiring Australia grant to Jim Gehling and his team to run a training project entitled: "Hidden National Treasure: The Ediacara Fossils and Geology of the Flinders Ranges in South Australia" for tour operators and natural history custodians in the northern South Australia.

Added to this has been the in kind support provided by the Saudi Geological Survey, INSUEGO at the University of Tucuman, Argentina, the Paleontological Institute, Russian Academy of Sciences (Moscow), Monash University, the Palaeontological Society of India (Lucknow), and the OIST (Okinawa Institute of Science and Technology, Japan) – to support research visits and cooperative field work in India, Australia, Saudi Arabia, Argentina, Russia, and Japan.

10. What tangible improvements has your project obtained?

The added funding and in kind support from the institutions noted in item 9 provided support that allowed significant student participation in both the field conferences in Brazil and Saudi Arabia. Further interaction with students and young researchers occurred when many of the IGCP participants provided public lectures in many places including Japan, Singapore, Argentina, Turkey, Brazil and other parts of the globe.

11. What kinds of outreach and training has your project undertaken?

Especially in Brazil many young researchers, including many young women, were able to attend the Corumba meeting due to funding provided by IGCP587. Ongoing research with many of these has be another outcome. In Saudi Arabia, our work there has encouraged young staff at the Saudi Geological Survey to apply for higher degrees, with mentoring from IGCP587 participants. The IGCP support has also encourage the Explorers Club of New York to sponsor a new PhD student to attend the next field conference in Namibia as well as the IGCP Australian Committee provided further grants for student attendance at the Brazilian and Saudi Arabian conferences – and these are just a few examples – there are many more.

In 2013 Jim Gehling and his team in Adelaide have obtained a permit to make a trial excavation in the Ediacara Conservation Park, near Reg Sprigg's famous discovery site. As a result they have discovered the source beds of some of the classic type material dating back to the late 1950's. The Ediacara Fossil Gallery will be completed before the end of 2013, exhibiting a composite sample of a fossil bed from the Ediacara CP, in addition to the wall display of a fossil bed from the Heysen Range, south of Parachilna Gorge.

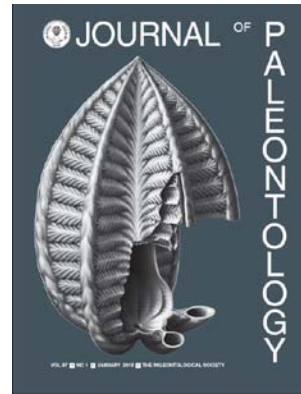
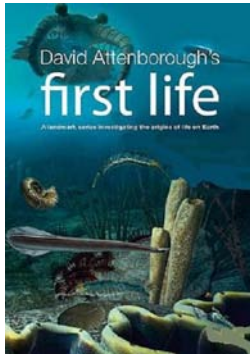
12. What kind of public information has your project generated? And how do you evaluate their impact?

Many participants in IGCP587 have been involved repeatedly in radio, tv and in depth interviews in many different countries, in particular Singapore, Australia, Canada and Russia. In fact, it is difficult to keep track of these, but from frequent requests to use imagery and quotes from recent publication, this is one way to judge the effectiveness of the public interest. Two short documentaries were made to accompany the Singapore exhibitions concerning discoveries that were part of IGCP587 in Namibia and Saudi Arabia.

13. Attach any information you may consider relevant

Material available on website:

<http://monash.edu/science/about/schools/geosciences/prec>



First Life provided the final episode in Attenborough's Life Series and it garnered 3 Emmy awards for the best doco. It was proposed by members of IGCP587 and followed up. It was also inspired by Fedonkin, et al., 2007. *The Rise of Animals. Evolution and Diversification of the Kingdom Animalia*, Johns Hopkins University Press, Baltimore, written by several participants in IGCP493 and successor project IGCP587. Far right, 2013 Cover article in *Journal of Paleontology* concerning new Namibian *Rangea* material recovered as part of IGCP587.