

INTERNATIONAL GEOSCIENCE PROGRAMME (IGCP)



Annual report of the IGCP Project n° 580



IGCP short title:

Application of magnetic susceptibility on Palaeozoic sedimentary rocks

Duration: 5 years (2009-2013); status: first year.

Website address related to the project

<http://www2.ulg.ac.be/geolsed/MS>

Project leaders:**Anne-Christine da Silva**

Pétrologie sédimentaire, B20, Boulevard du Rectorat 15, Université de Liège, 4000 Liège
Belgium
Tel: 0032-43662258
Fax: 0032-43662029
E-mail: ac.dasilva@ulg.ac.be

Michael T. Whalen,

Dept. of Geology and Geophysics, University of Alaska Fairbanks, Fairbanks, AK 99775
U.S.A.
Tel: 907-474-5302
Fax: 907-474-5163
E-mail: mtwhalen@gi.alaska.edu

Jindrich Hladil,

Institute of Geology AS CR, v.v.i., Academy of Sciences, Rozvojova 269, 165 00 Prague 6
Czech Republic
Tel: 00420-233087238
Fax: 00420-220922670
E-mail: hladil@gli.cas.cz

Daizhao Chen

Institute of Geology and Geophysics, Chinese Academy of Sciences, #19 Beitucheng Xilu, Chaoyang
District, Beijing 100029
China
Tel: 86-10-82998112 (work)
86-10-62008256 (home)
E-mail: dzh-chen@mail.iggcas.ac.cn

Simo Spassov

Section du Magnétisme Environnemental, Centre de Physique du Globe de l'Institut Royal
Météorologique de Belgique, Rue du Centre 1, B-5670 Dourbes (Viroinval)
Belgium
Tel: +32 60 395 424
Fax: +32 60 395 423
E-mail: simo.spassov@oma.be

Frederic Boulvain

Pétrologie sédimentaire, B20, Boulevard du Rectorat 15, Université de Liège, 4000 Liège
Belgium
Tel: 0032-43662252
Fax: 0032-43662029
E-mail: fboulvain@ulg.ac.be

Devleeschouwer Xavier

Département des Sciences de la Terre et de l'Environnement (DSTE), Laboratoire de Sédimentologie
et de Géodynamique des Bassins, 50 Avenue F.D. Roosevelt, Université Libre de Bruxelles CP160/02,
1050 Bruxelles
Belgium
Tel: 0032-26504714
Fax: 0032-26502226
E-mail: xdevlees@ulb.ac.be

Project Secretary / Webmaster:

Anne-Christine da Silva

Pétrologie sédimentaire, B20, Boulevard du Rectorat 15, Université de Liège, 4000 Liège
Belgium

Tel: 0032-43662258

Fax: 0032-43662029

E-mail: ac.dasilva@ulg.ac.be

Date of submission of report : 14/12/2009

Signature of project leader(s):



A handwritten signature in blue ink, appearing to read 'A. da Silva', is written over a horizontal line.

1. Website address related to the project

<http://www2.ulg.ac.be/geolsed/MS/>

2. Summary of major past achievements of the project

⇒ IGCP 580 community consists of 118 researchers, from 37 countries (including developing countries Kenya, Namibia, Vietnam, Uzbekistan, Algeria, Tunisia, etc.)

⇒ Presentation of the project or of results directly related to the project at different meetings:

- Paleomagnetic studies of Devonian rocks in Poland and Czech Republic: geological implications, International Workshop, Feb. 18 2009, Warsaw.
- Paleozoic and Devonian meeting: Prague, Czech Republic, May 2009
- 9th North America Paleontological Convention, Ohio, 21-26 June 2009.
- SEPM-CES SEDIMENT 2009: Krakow, Poland, 24-25 June 2009
- IAGA meeting, Sopron, Hungary, August 2009
- carbonate mounds in shallow and deep time, Oviedo, Sept. 16th – 20th 2009
- 12th ASF meeting, Rennes, 25-31 October 2009
- GSA Annual Meeting, Portland, 12-21 October 2009

⇒ Link with other IGCP project (IGCP-499 Devonian land-sea interaction: evolution of ecosystems and climate, contact Königshof Peter)

⇒ Creation of a communication platform on the application of magnetic susceptibility in paleoenvironmental studies (website address: <http://www2.ulg.ac.be/geolsed/MS/>). This website includes all the data about the IGCP-580 project (background, project participants and leaders), information about the application of magnetic susceptibility in palaeoenvironmental studies (references, lectures and links) and information about the IGCP.

⇒ Organisation of a first IGCP-580 meeting in Liège (2 to 6 Decembre 2009) with 44 participants, from 18 countries. The meeting was organized by Anne-Christine da Silva and Frédéric Boulvain.

⇒ Approval by the scientific committee of Geologica Belgica (impact factor 0.522) of a special issue of the Journal related to the IGCP 580 meeting (Magnetic susceptibility, correlations and paleoenvironments, editors: da Silva, AC and Boulvain, F.). 12 papers were submitted for this special issue.

3. Achievement of the project this year only

*3.1. List of countries involved in the project (*countries active this year)*

Algeria*, Argentina, Australia, Austria, Belgium*, Brazil, Bulgaria, Canada, China, Czech Republic*, Egypt, Estonia*, Finland, France*, Germany*, Greece, Iran*, Iraq, Italy, Japan, Kenya, Libya, Lithuania, Morocco*, Namibia*, Netherlands*, Poland*, Portugal*, Russia*, Senegal, Spain, Tunisia*, Turkey*, U.K.*, U.S.A.*, Uzbekistan, Vietnam*

3.2. General scientific achievements and social benefits

This project concerns the application of magnetic susceptibility (MS) on sediments and sedimentary rock. Applied measurements are bulk not oriented magnetic susceptibility measurements, which is mostly related to the content of magnetic minerals in the rock and so probably mostly related to detrital inputs. Magnetic susceptibility is in most circumstances linked directly to lithogenic inputs and so to the main environmental parameters (climate and sea level). Magnetic susceptibility has thus been used for correlations and paleoenvironmental reconstructions.

The main objectives of the IGCP-580 program are:

- 1) Compiling the available MS data from the different researchers and to continue to collect new data in the field (with a main focus on the Devonian), to test the correlative power of the technique and the influence of facies and sedimentological parameters on MS signal. This compilation is also related to the creation of a data base on the IGCP-580 website.
- 2) Collecting information on the origin of magnetic minerals leading to the MS signal
- 3) In light of the accumulating MS results our project encourages further development of detailed MS records to assist with correlations, reconstructing past climatic variations, and astronomical calibration of the Paleozoic timescale.

The program started in mid April 2009 (date of receipt of the project assessment) but some substantial results were already obtained. In respect with the first objective of compiling available MS data, a communication platform and database was created. The website is designed to be used as a platform to announce future initiatives related to the IGCP-580 but also to share knowledge (database, list of references, lectures). The database is still in progress and we intend to intensify this interactive platform. However, the list of publications on MS already includes hundreds of references and the lecture section includes 4 lectures (which were presented at the first IGCP-meeting in Liège). The first results on collaborative correlations were proposed at the meeting in Liège (correlations of the Middle and Upper Devonian between Belgium and Czech Republic) as well as analysis of the origin of the magnetic minerals (MS is dominated by detritic inputs but in a few cases like hematitic carbonates, the influence of diagenesis is obvious). These first results with others presented at the Liège meeting have been submitted for a special issue of *Geologica Belgica* (12 papers submitted).

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

⇒ Organisation of a first IGCP-580 meeting in Liège (2 to 6 Decembre 2009) with 44 participants, from 18 countries. The meeting was organized by Anne-Christine da Silva and Frédéric Boulvain. The meeting was divided in two days of presentations (3 Keynote speakers, 23 talks and 11 posters), one day field trip (35 participants) and two days of training (see section 3.4).

3.4. Educational, training or capacity building activities

1) A training workshop was organized during the first IGCP-580 meeting in Liège. Presentations are available on the website: <http://www2.ulg.ac.be/geolsed/MS/lectures.html>. Eleven scientists from developing countries and young scientists (see paragraph 3.5) were helped by IGCP-580 grants to attend the meeting and the training.

- B.B. Ellwood (LSU, USA): Magnetic susceptibility: instruments, units, standardization and various approaches for using MS data sets for correlations
- S. Spassov (IRM, Belgium): The potential of mineral magnetism for studying past and present environments.
- M. Chadima (AGICO) Magnetic susceptibility and its variations with temperature, measuring field and operating frequency: examples from various rock types
- X. Devleeschouwer (ULB, Belgium): Rock magnetism in the sedimentary record: history of magnetism, magnetic mineralogy; magnetic susceptibility thermomagnetism and hysteresis applications conducted simultaneously
- Device demonstrations, practical demonstrations and basic introduction into the measuring techniques. Meeting participants - preferably those who do not own any magnetic susceptibility instrument - could measure samples free of charge with assistance of a technician.
- Visit to Dourbes “Institut de Géophysique du Globe de l’IRM” and of the devices and facilities which are accessible for researcher included in the program.

2) The library of references on the website is an important element and contains a list of relevant scientific publications related to the program.

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

We sponsored 11 scientists from Morocco, Algeria, Russia, Namibia, Poland, Portugal, Turkey, Vietnam, Estonia, Czech Republic and Iran. Furthermore, the scientists from Algeria and Iran stayed longer in Belgium in order to perform their magnetic susceptibility measurements in the University of Liège (free of charge).

3.6. List of most important publications

Distinguish between peer-reviewed literature and other (no abstracts)

Peer-reviewed papers:

- Boulvain, F., Mabilille, C., Poulain, G., da Silva, A.C. (2010): short note: A magnetic susceptibility curve for the Devonian Limestone from Belgium. *Geologica Belgica*, 13, 113-117. <http://popups.ulg.ac.be/Geol/document.php?id=2880>
- Hladil, J., Koptikova, L., Galle, A., Sedlacek, V., Pruner, P., Schnabl, P., Langrova, A., Babek, O., Frana, J., Hladikova, J., Otava, J., Gersl, M. (2009). Early Middle Frasnian platform reef strata in the Moravian Karst interpreted as recording the atmospheric dust changes: the key to understanding perturbations in the punctata conodont Zone. *Bulletin of Geosciences*, 84: 75-106.
- Koptikova, L., Hladil, J., Slavik, L., Frana, J., 2009. Lochkovian-Pragian boundary in the Prague Synform: lithological, mineralogical, geophysical and geochemical aspects as results of sea-level fall. In: Suttner, T.J., Berkyova, S., Hubmann, B., Koptikova, L., Slavik, L. (Eds.), 2009. *Regional Devonian Workshop Prague & Graz: Prague, 25-27th May 2009. Berichte der Geologischen Bundesanstalt (Verlag der Geologischen Bundesanstalt, Wien)*, 79: 28-31.
- Machado, G., Hladil, J., Koptikova, L., Fonseca, P.E., Rocha, F.T., Galle, A. (2009). The Odivelas Limestone: evidence for a Middle Devonian reef system in western Ossa-Morena Zone (Portugal). *Geologica Carpathica*, 60: 121-137.

Selected bibliography 2009

Peer-reviewed papers

- Ao, H., Dekkers, M.J., Deng, C. and Zhu, R. (2009). Palaeoclimatic significance of the Xiantai fluvio-lacustrine sequence in the Nihewan Basin (North China), based on rock magnetic properties and clay mineralogy, *Geophys. J. Int.*, doi: 10.1111/j.1365-246X.2008.04082.x
- da Silva, A.C., Potma, K., Weissenberger, J.A.W., Whalen, M.T., Humblet, M., Mabilie, C., Boulvain, F., (2009) Magnetic susceptibility evolution and sedimentary environments on carbonate platform sediments and atolls, comparison of the Frasnian from Belgium and from Alberta. *Sedimentary Geology*, 214, 3-18.
- da Silva, A.C., Mabilie, C. & Boulvain, F. (2009) Influence of sedimentary setting on the use of magnetic susceptibility: examples from the Devonian of Belgium, 56, 1292-1306.
- Debacker, T.N., Hirt, A., Sintubin, M. & Robion, P. 2009. Comparing magnetic and mineral fabrics in low-grade, cleaved siliciclastic pelites: a case study from the Anglo-Brabant Deformation Belt (Belgium). *Tectonophysics*. 466, 32-46
- Ellwood, B.B., Tomkin, J.H., El Hassani, A., Bultynck, P., Brett, C.E., Schindler, E., Feist, R., Bartholomew, A., 2009. A climate-driven model and development of a floating point time scale for the entire Middle Devonian Givetian Stage: A test using magnetostratigraphic susceptibility as a climate proxy. *Palaeogeography, Palaeoclimatology, Palaeoecology*, in press.
- Ellwood, B.B., Kafafy, A., Kassab, A., Abdeldayem, A., Obaidalla, N., Howe, R.W., Sikora, P., 2009. Magnetostratigraphy Susceptibility Used for High Resolution Correlation among Santonian (Upper Cretaceous) Marine Sedimentary Sequences in the U.S. Western Interior Seaway and the Western Sinai Peninsula, Egypt. In *Modern Stratigraphic techniques: Theories and Case Histories*, eds. Ratcliffe, K. and B. Zaitlin, SEPM Special Publication, in press.
- Ellwood, B.B., Kafafy, A., Kassab, A., Tomkin, J.H., Abdeldayem, A., Obaidalla, N., Willson, K., Thompson, D.E., 2009. Magnetostratigraphy Susceptibility Used for High Resolution Correlation Among Paleocene/Eocene Boundary Sequences in Egypt, Spain and the U.S.A. In *Modern Stratigraphic techniques: Theories and Case Histories*, eds. Ratcliffe, K. and B. Zaitlin, SEPM Special Publication, in press.
- Pruner, P., Houša, V., Olóriz, F., Košťák, M., Krs, M., Man, O., Schnabl, P., Venhodová, D., Tavera, J.M. and Mazuch, M.: High-resolution magnetostratigraphy and biostratigraphic zonation of the Jurassic/Cretaceous boundary strata in the Puerto Escaño section (southern Spain). *Cretaceous Research*, Article in Press, Corrected Proof
- Whalen, M.T., and Day, J.E., in review, Cross-basin variations in magnetic susceptibility influenced by changing sea level and paleogeography, Upper Devonian western Canada sedimentary basin, *Journal of Sedimentary Research*.

Book chapter

- Foubert, A. and Henriot, J.P. (2009) Magnetic Record of a Carbonate Mound. In: *Nature and significance of the Recent Carbonate Mound record. The Mound Challenger Code*. Springer. Lecture notes in earth sciences, Volume 126/2009. p121-166. (DOI 10.1007/978-3-642-00290-8)

3.7. Activities involving other IGCP Projects, UNESCO, IUGS or others

Active participation of Peter Königshof (leader IGCP 499) to the First IGCP-580 meeting, a close collaboration and coordination of activities was agreed between IGCP-499 and -580.

Active participation of IGCP-580 members (Jindrich Hladil and Leona Koptikova) to the Regional Devonian Workshop (Prague & Graz) (25-27 May 2009) which is part of the IGCP-497 and 499.

4. Activities planned

4.1. General goals

⇒ Publishing a first special issue in relation with the first IGCP-580 meeting in Liege in *Geologica Belgica* (IF: 0.522) “application of magnetic susceptibility, correlations and palaeoenvironments” – Edited by da Silva, AC. and Boulvain, F.

⇒ Extending relationship with IGCP-499 and its potential successor.

⇒ Organization of meetings, field trip, special sessions at international meetings and to plan the activities for 2011

4.2. Tentative list of specific meetings and field trips

⇒ Special session at the meeting “STRATI 2010”, fourth “French” meeting on stratigraphy. 30 August to the 2 Septembre 2010, Université Pierre et Marie Curie Paris VI. <http://paleopolis.rediris.es/STRATI2010/>. Convener : X. Devleeschouwer

⇒ Contact are in progress for a special session at the SEPM SEDIMENT 2010, Potsdam, June 25-27, 2010

⇒ Second meeting IGCP-580, field trip and extended field work in China (Sampling of Devonian sections), autumn 2010. Complete schedule, field trip area and expenses will be published as soon as possible on the website.

5. Project funding requested

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

7. Financial statement (\$ USD only)

The main expenses have been allocated to help 11 scientists, mostly from developing countries to attend the first IGCP-580 meeting in Liège (El Hassani, A.-Morocco; Izokh, O.-Russia; Kamona, F.-Namibia; Sobien, K.-Poland; Machado, G.-Portugal; Mäkaroglu, O.-Turkey; Phuang, L.-Vietnam; Predeen, U.-Estonia; Sardarabadi, M.-Iran and Vacek, F.-Czech Republic).

Further funding has been obtained from the Belgian National Science Foundation (3500€) and Liège University (1000€) to organize the meeting in Liège.

8. Attach any information you may consider relevant

List of abstracts presenting the IGCP-580 project in different meetings (1), list of abstracts presented at the IGCP-580 meeting in Liège (2), pdf of papers mentioning the IGCP-580 project (3) and copy of a local newspaper article (newspaper from Liège University) (4).