

# INTERNATIONAL GEOSCIENCE PROGRAMME (IGCP)



## Annual Report\* of IGCP Project No. 580

**\*NOTE: MAXIMUM LENGTH OF THE TEXT REPORT IS 5 (FIVE) PAGES. SINGLE SPACE, 12 POINT FONT. REPORTS EXCEEDING THIS LENGTH WILL BE RETURNED TO THE AUTHOR(S) WITH THE REQUEST OF REDUCING THE TEXT TO THE ABOVE STANDARD.**

The scientific information in this report will further be used for publication on the IGCP website under the new electronic version of 'Geological Correlation' (please feel free to attach any additional information you may consider relevant to the assessment of your project).

IGCP project short title: Application of magnetic susceptibility on Palaeozoic sedimentary rocks

Duration: 5 years (second year)

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Date of submission of report:

Signature of project leader(s):



# **Guidelines for Annual Report**

(December 2010)

## **1. Website address(es) related to the project:**

[www.ulg.ac.be/geolsed/MS](http://www.ulg.ac.be/geolsed/MS)

## **2. Summary of major past achievements of the project**

❖ IGCP 580 community consists of 152 researchers, from 44 countries (including developing countries Kenya, Namibia, Vietnam, Uzbekistan, Algeria, Tunisia, Colombia, Nigeria, India, etc.)

❖ Presentation of the project or of results in direct relation with the project at different meetings, organization of a special session in an international meeting and of 2 meetings (Belgium and China) dedicated to the IGCP-580.

❖ Publications of various papers in different high ranking scientific journals (e.g. International Journal of Earth Sciences, Geological Bulletin, Sedimentary Geology, Journal of Sedimentary Research, Polish Geological Review, etc.) and of a special issue of *Geologica Belgica* (IF2009: 0.655).

❖ Creation of a communication platform (website) on the application of magnetic susceptibility in paleoenvironmental studies.

## **3. Achievements of the project this year only**

### *3.1. List of countries involved in the project (please \*indicate the countries active this year)*

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

### *3.2. General scientific achievements and social benefits*

#### ❖ Scientific achievements

This project concerns the application of magnetic susceptibility (MS) on sediments and sedimentary rock. Applied measurements are bulk not oriented MS measurements, which are mostly related to the content of magnetic minerals into the rock and so probably mostly related to detrital inputs. Magnetic susceptibility has 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); (2) Collecting information on the origin of magnetic minerals leading to the MS signal; and (3) in the light of the obtained results, to better compel the application of MS in applying MS for correlations and to reconstruct climatic variations.

Some substantial results were already obtained:

(1) Compiling the available MS data: 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). Some results were already presented on the comparisons of available MS data (comparison of the signal in

Recent and ancient mud mounds and comparison of the signal of the Devonian of Belgium and Czech Republic). Other comparisons are in progress.

(2) Acquisition of new data: team work for the acquisition of new data in the Area of Guilin in China, sampling of 8 sections (3 Givetian to Frasnian sections, 2 Frasnian/Famennian boundary sections and 2 Devonian/Carboniferous boundary sections), with a total of about 1700 samples.

(3) Collecting information on the origin of magnetic minerals leading to the MS signal: (a) Intensive magnetic measurements (hysteresis, IRM and Curie temperature) on different sections (Devleeschouwer Upper Eifelian to Frasnian in Europe and Da Silva and Boulvain on the Frasnian and the Givetian of Belgium; (b) Dissolution of carbonates and direct observations of the insoluble residue (Hladil, Koptikova); (c) Comparisons with other proxies for a better understanding of the MS signal (M. Whalen, comparison with geochemical proxies; Riquier and da Silva and Boulvain, comparison with detritic proxies (Ti, Si, Zr) and facies and fossil contents; Hladil et al., comparison with gamma ray spectrometry).

#### ❖ Social benefits

Magnetic susceptibility measurements are easy and cheap to acquire. For this reason, this is an interesting and accessible technique for developing countries. The IGCP-580 and UNESCO funding allowed people from developing countries to join our meetings and to start new collaborations (measurements in one of the participating laboratory for scientists from Vietnam, Senegal, India, Iran, Tunisia, and Cameroun). Furthermore, a new project on the magnetic susceptibility of the Cenozoic of Colombia is starting and (if the proposal is funded) a training will be organized in Colombia (between 1 and 2 weeks, theoretical and technical training) and intensive collaborations will start.

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

##### ❖ Presentation of results related to the IGCP-580 at different meetings

- Central European Tectonic Group Studies, Poland (April 2010)
- GSA meeting, Denver, U.S.A. (end October)
- ISC meeting, Mendoza, Argentina (end September)

##### ❖ IGCP-580 special session and presentation of the IGCP-580 project

○ Strati 2010, Paris: special session organized by X. Devleeschouwer on the application of magnetic susceptibility on Palaeozoic rocks. Paris, 30 august – 2 September 2010.

○ Castle meeting, Czech Republic, Nove Hradky, 29<sup>th</sup> august, to the 4<sup>th</sup> September (AC da Silva presented the IGCP-580 project and results).

❖ Organisation of the second IGCP-580 meeting in Guilin, China (28 Novembre to 4 Decembre 2010) with 52 participants, from 8 countries. The meeting was organized by Daizhao Chen and Anne-Christine da Silva (co-chair). After a first day of meeting, we had 2 days of field trip organized by D. Chen to give to all participants an overview of the Devonian in the area of Guilin. Then we had 4 days of team work sampling, with four international teams, working on 7 sections (total of 1700 samples). This work was supervised by D. Chen (China) and allowed the participation of 8 PhD students or young researchers from China and the training of one scientist from India and one from Senegal.

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

As mentioned before, the IGCP-580 meeting and the website platform allowed to start collaborations with scientists from developing countries (easy access to facilities and scientific exchanges for scientists from Vietnam, Iran, Senegal, India and Colombia). The library of references on the website is an important element and contains a list of relevant scientific publications related to the program. The website also includes the trainings proposed during the IGCP-580 program. A number of PhD students from different countries are members of the project. They strongly benefited from discussions over the magnetic susceptibility problems or over their current work during meetings (or by email) and from participation to the field trip.

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

We sponsored 9 scientists to join the second IGCP-580 meeting in Guilin, China (1 from Senegal, 1 from Vietnam, 4 from Czech Republic, 1 from India, 1 from Poland and 1 from China). Women and young scientists actively involved in the project: from Vietnam, Estonia, Czech Republic, Poland and Iran.

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

*Bibliography (listed by author in alphabetical order with the most recent work listed first)*

A special issue of *Geologica Belgica* is now published (following the first IGCP-580 meeting) and contains 13 papers (+ abstracts of the meeting on the online version). The complete reference of the volume is: Magnetic susceptibility, correlations and Palaeozoic environments, eds. Da Silva & Boulvain. *Geologica Belgica*, 13/4; and it will be referred as GB13 in the following list.

- Babek, O, Klavoda, J, Aretz, M, Cossey, PJ, Devuyst, X, Herbig, HG, Sevastopulo, G (2010) The correlation potential of magnetic susceptibility and outcrop gamma-ray logs at Tournaisian-Viséan boundary sections in western Europe. GB13, 291-308.
- Boulvain, F, Da Silva, AC (2010) Frasnian reefs, mounds and atolls from Belgium: sedimentology and magnetic susceptibility – A FIELDTRIP GUIDEBOOK. GB13, 482-496.
- Boulvain, F, Da Silva, AC, Mabilie, C, Hladil, J, Gersl, M, Koptikova, L, Schnabl, P (2010) Magnetic susceptibility correlation of km-thick Eifelian–Frasnian sections (Ardennes and Moravia). GB13, 309-318.
- Boulvain, F, Mabilie, C, Poulain, G, Da Silva, AC (2010): short note: A magnetic susceptibility curve for the Devonian Limestone from Belgium. *Geologica Belgica*, 13/1, 113-117.
- Da Silva, AC, Boulvain, F (2010) Magnetic susceptibility, correlations and Paleozoic environments: Foreword. GB13, 287-290.
- Da Silva, AC, Yans, J, Boulvain, F (2010) Early-Middle Frasnian (early late Devonian) sedimentology and magnetic susceptibility of the Ardennes area: identification of severe and rapid sea-level fluctuations. GB13, 319-332.
- Debacker, T, Sintubin, M, Robion, P (2010) On the use of magnetic techniques for stratigraphic purposes: examples from the Lower Palaeozoic Anglo-Brabant Deformation Belt (Belgium). GB13, 333-350.

- Devleeschouwer, X, Petitclerc, E, Spassov, S, Pr  at, A (2010) The Givetian-Frasnian boundary at Nismes parastratotype (Belgium): the magnetic susceptibility signal controlled by ferromagnetic minerals. GB13, 351-366.
- Hladil, J, Cejchan, P, Babek, O, Koptikova, L, Navratil, T, Kubinova, P (2010) Dust – A geology-orientated attempt to reappraise the natural components, amounts, inputs to sediment, and importance for correlation purposes. GB13, 367-384.
- Hladil, J, Vondra, M, Cejchan, P, Vich, R, Koptikova, L, Slavik, L (2010) The dynamic time-warping approach to comparison of magnetic-susceptibility logs and application to Lower Devonian calciturbidites (Prague Synform, Bohemian Massif). GB13, 385-406.
- Koptikova, L, Hladil, J, Slavik, L, Cejchan, P, Babek, O (2010) Fine-grained non-carbonate particles embedded in neritic to pelagic limestones (Lochkovian to Emsian, Prague synform, Czech Republic): composition, provenance and links to magnetic susceptibility and gamma-ray logs. GB13, 407-430.
- Koptikova, L, Babek, O, Hladil, J, Kalvoda, J, Slavik, L (2010) Stratigraphic significance and resolution of spectral reflectance logs in Lower Devonian carbonates of the Barrandian area, Czech Republic; a correlation with magnetic susceptibility and gamma-ray logs. *Sedimentary Geology*, 225: 83-98.
- Machado, G, Hladil, J, Slavik, L, Koptikova, L, Moreira, N, Fonseca, M, Fonseca, P (2010) An Emsian-Eifelian Calciturbidite sequence and the possible correlatable pattern of the Basal Chote   event in Western Ossa-Morena Zone, Portugal (Odivelas Limestone). GB13, 431-446.
- Michel, J, Boulvain, F, Philippo, S, Da Silva, AC (2010) Palaeo-environmental study and small scale correlations using facies analysis and magnetic susceptibility of the mid-Emsian (Himmelbaach Quarry, Luxembourg). GB13, 447-458.
- Riquier, L, Averbuch, O, Devleeschouwer, X, Tribovillard, N (2010) Diagenetic versus detrital origin of the magnetic susceptibility variations in some carbonate Frasnian–Famennian boundary sections from Northern Africa and Western Europe: implications for paleoenvironmental reconstructions. *International Journal of Earth Sciences*, 99 (Suppl 1): S57–S73.
- Sliwinski, MG, Whalen, MT, Day, J (2010) Trace element variations in the Middle Frasnian punctata zone (Late Devonian) in the Western Canada sedimentary basin – changes in oceanic bioproductivity and paleoredox spurred by a pulse of terrestrial afforestation? GB13, 458-482.
- Whalen, M.T., Day, J.E., 2010, Cross-basin variations in magnetic susceptibility influenced by changing sea level, paleogeography, and paleoclimate; Upper Devonian, Western Canada Sedimentary Basin, *Journal of Sedimentary Research*, v. 80, p. 1109–1127

### *3.7. Activities involving other IGCP projects, UNESCO, IUGS or others*

Collaboration with a recently funded research project: IGCP program of the Austrian Academy of Sciences: Gamma-ray spectrometry (GRS) and Magnetic susceptibility (MS) applied on the Devonian sequence of the Carnic Alps for high-resolution stratigraphic correlation (T. Suttner). Strong support and future collaboration planned with the submitted IGCP project “Climate change and biodiversity patterns in the Mid-Paleozoic”, main leader P. Koenighsof.

## **4. Activities planned**

### *4.1. General goals*

As mentioned before, the main goal of the IGCP-580 program are (1) Compiling the available MS data and to continue to collect new data in the field; (2)

Collecting information on the origin of magnetic minerals leading to the MS signal; and (3) to better compel the application of MS for correlations and to reconstruct climatic variations.

With the 1700 samples collected in China, the different teams will work on the MS measurements, sedimentological analyses, geochemical analyses ( $\delta^{18}\text{O}$ ,  $\delta^{13}\text{C}$ ,  $\delta^{13}\text{C}_{\text{org}}$ , major and trace elements) and additional magnetic analyses (mostly hysteresis). This work will be done in collaboration between all the team members and all results from the different teams will be compared to get a picture as complete as possible of the MS evolution during the Devonian in China. Then these results will be compared with the results already acquired (mostly Belgium, Canada, Czech Republic and Poland).

In the next year, further sampling and team work will be planned (see hereunder, section 4.2) to collect further data and increase our knowledge of the MS signal. Some papers directly related to the IGCP-580 project will be submitted to Terra Nova in April 2011 (X. Devleeschouwer).

*4.2. Tentative list of specific meetings and field trips (please list the participating countries)*

In 2011, the third IGCP-580 meeting is planned in Prague, Czech Republic. During this meeting a training will be proposed to all the participants and a field trip for sampling will be organized (focus on the Emsian).

**5. Project funding requested**

We request 7500\$ (as received in 2010). However, if an increase is possible it would be more than welcome as for both our IGCP-580 meetings, some participants were not able to join due to insufficient founding (participants from Tunisia, Kenya, Senegal, Cameroun and U.S.A.). Next year, a training will be organize and participants from developing countries would be glad to benefit from financial support (some request already from Colombia, Namibia, Senegal).

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

N/A

**7. Financial statement (\$ USD only)**

*The IGCP Scientific Board would like to be informed how the IGCP funds were used and if additional funding was obtained from different sources.*

7250\$ were attributed to 9 participants (details above). Organization of the second IGCP-meeting was supported by National Natural Science Foundation of China (NSFC, 50000 RMB = 7576 USD\$) and Chinese Academy of Sciences (CAS, 40000 RMB = 6061 USD\$). Furthermore, each main working team benefited of local financial sources for research expenses (Belgian Science Foundation (FNRS), Belgian Geologica Survey, Czech Academy of Science, National Science Foundation (NSF), etc.).

**8. Attach any information you may consider relevant**

Abstracts list, program of the IGCP-580 meeting at Guilin and main papers.