

The IGCP Project 580 Application of magnetic susceptibility on Paleozoic sedimentary rocks has been launched: the project outlines, scope and the first results related to Central European region

KOPIKOVÁ, L.^{1,2}, HLADIL, J.¹, DA SILVA, A.C.³, WHALEN, M.T.⁴, BOULVAIN, F.³, CHEN, D.⁵, SPASSOV, S.⁶ & DEVLEESCHOUWER, X.⁷

(1) Institute of Geology, AS CR, v.v.i., Rozvojová 269, 16500 Prague 6, Czech Republic; *koptikova@gli.cas.cz*, *hladil@gli.cas.cz*

(2) Institute of Geology and Palaeontology, Charles University, Albertov 6, 12843 Prague 2, Czech Republic

(3) Pétrologie sédimentaire, B20, Université de Liège, Boulevard du Rectorat 15, 4000 Liège, Belgium; *ac.dasilva@ulg.ac.be*, *fboulvain@ulg.ac.be*

(4) Department of Geology and Geophysics, University of Alaska Fairbanks, Fairbanks, AK 99775, U.S.A.; *mtwhalen@gi.alaska.edu*

(5) Institute of Geology and Geophysics, Chinese Academy of Sciences, 19 Beitucheng Xilu, Chaoyang District, Beijing 100029, China, *dzh-chen@mail.iggcas.ac.cn*

(6) 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; *simo.spasov@oma.be*

(7) Département des Sciences de la Terre et de l'Environnement (DSTE), Laboratoire de Sédimentologie et de Géodynamique des Bassins, Université Libre de Bruxelles CP160/02, 50 Avenue F.D. Roosevelt, 1050 Bruxelles, Belgium; *xdevlees@ulb.ac.be*

The recently started IGCP 580 (UNESCO-IUGS) project entitled "Application of magnetic susceptibility as a paleoclimatic proxy on Paleozoic sedimentary rocks and characterization of the magnetic signal" will run for a duration of 5 years with the opening-meeting scheduled for December 2009 at the University of Liège, in Belgium - compare the project pages at <http://www2.ulg.ac.be/geolsed/MS/news.htm>. The project proposers, led by A.C. DA SILVA, hope this project finally puts the rapidly developing North American and European schools of magnetic susceptibility stratigraphy (MS) with related (paleo)environmental research on a footing with all their counterparts from different corners of the world. The concept of this project is to bring together the magnetic susceptibility eventstratigraphy and cyclostratigraphy methods (CRICK et al. 1997, ELLWOOD et al. 1999, 2009) with the MS-GRS (i.e., gamma-ray spectrometric) and geochemical stratigraphic detection of the background sedimentary influences (HLADIL 2002, HLADIL et al. 2006, 2009) and magnetic susceptibility stratigraphy methods which are developed particularly with respect to detailed facies relationships (DA SILVA & BOULVAIN 2002, DA SILVA et al. 2009) or diagenesis (SCHNEIDER et al. 2004, NAWROCKI et al. 2008).

A scope of the project has been defined around MS and Devonian carbonate sedimentary rocks, by focusing on magnetism, mineral phases, complex impurities in limestone and other relevant problems. This project, however, encompasses also a lot of problems about biostratigraphy, lithology, environment and Earth system evolution to continue, in these (paleo)environmental aspects, the international highlights of the IGCP 499 and 497 projects – the very successful projects, but in their terminal stage and on the O.E.T. status in 2009. Hence, there are a lot of relevant research subjects which are crossing the natural science and exact disciplines. With this extended plan, it gives participants of the IGCP 580 the ability to extend numerous related tasks in the Earth system studies, correlation and comparison (up to the present day geology and climate forcing of the background sedimentation and diagenesis; Phanerozoic and Recent, and also present and future settings). In spite of these ambitious first and second plan project goals, the practical and core subject is to collect new data-sets on magnetic susceptibility stratigraphy (MS) in field and to enhance the database of MS logs already available (main focus: Devonian strata). Actually, this database then should be used to find out more about the origin of MS signals through interdisciplinary cooperation with specialists on geochemistry, geophysics, sedimentology and other disciplines. Until now more than 80 scientists agreed to contribute to this project for better understanding of (paleo)climatic variations during the Devonian Period by using this method.

What is behind the MS variation in background-sedimentation sensitive sedimentary records? - Quantitative magnetic susceptibility (MS) measurements on sedimentary rocks are considered as a proxy for impurities transported to the final depositional environments. As it is known that limestones (and also quartzose sandstones, or other “media” with diamagnetic components) have only very low magnetic response in contrast to weathering products that derived from the main land which show high MS values, the excursions in MS-logs are considered as a proxy for such detrital input. It is known from studies of Recent deposits that for example a drop in sea-level (and also cooling of the climate) is followed by an increased deposition of Fe-rich weathering products, as well as directly delivered or secondarily crystallized magnetic mineral phases, which is caused by the increased proportion of exposed continental mass and siliciclastic material. But also other factors like increased rainfall or glaciation are responsible for raised erosion-rates which influence values of detrital input. And, in addition, there is a very significant mechanism which is responsible for the inter-basinally and inter-continently comparable MS variations on the background sedimentation impurity components, and it is related to the seemingly inconspicuous but very effective atmospheric mineral dust and aerosol (high atmosphere) plus common eolian (lower to middle tropospheric) dispersal and deposition, where the long-term totals of the delivered particulates reach considerably high values (ZENDER et al. 2004, LAMBERT et al. 2008, HLADIL et al. 2006, 2009).

In sedimentology and integrative stratigraphy this method has become a common tool for correlation by using bulk samples (ELLWOOD et al. 1999), but the knowledge on variations in detrital input, reflected in MS-logs, can help us also in recognizing climatic changes which can provide additional information for reconstructing the Devonian paleoenvironment (KOPTIKOVA et al. 2008, HLADIL et al. 2009, DA SILVA et al. 2009). The current IGCP results in the MS studies made on the Devonian carbonate sequences in Central Europe are particularly connected with the composed sections “Moravia, carbonate platform” and “Barrandian area in Bohemia, mostly carbonate slope and pelagic facies”. The averaged MS-GRS data for the first complex are accessible at <http://home.gli.cas.cz/hladil/www/moravia-ms-grs-2005.htm> and an extensive MS-GRS database for the Devonian of the Barrandian area is in very advanced stage of compilation (the projects were started by J. HLADIL and recently continued by L. KOPTIKOVA). Another very promising chance appears to be the MS-GRS correlation with the Devonian of Graz and the Carnic Alps (Austria), where the GRS stratigraphic approach was developed for years (e.g. REISINGER & HUBMANN 1998). According to current correlation studies, the Central European MS-GRS sections show also a good potential for high-resolution correlation with composed logs from Poland, and with increasing distances also with the Belgian, Canadian, Uzbek, Nevadan or other MS sections in the world.

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Autor(en)/Author(s): Koptikova Leona, diverse

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