

Ber. Inst. Erdwiss. K.-F.-Univ. Graz	ISSN 1608-8166	Band 17	Graz 2012
IGCP 580, 4 th Annual Meeting		Graz, 24-30 th June 2012	

Magnetic susceptibility of Early Cretaceous sediments from northwest China and its implications

DAI, S.¹, LIU, H.-J.¹, DA SILVA, A.C.², HUANG, Y.-B.¹, ZHU, Q.³, ZHAO, J.¹, LIU, J.-W.¹, KONG, L.¹ & LIU, X.¹

- (1) Key Laboratory of Western China's Environmental Systems, Ministry of Education of China & College of Resources and Environment, Lanzhou University, Gansu 730000, China; daisher@lzu.edu.cn
- (2) Liège University, Sedimentary Petrology Laboratory, B20, Sart Tilman, 4000 Liège, Belgium; ac.dasilva@ulg.ac.be
- (3) Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences, Lanzhou 730000, China

Magnetic susceptibility (MS) had been classically used to study paleoclimatic variations recorded into loess-paleosol successions or into marine sediments. The application of MS as a paleoclimatic tool is based on the link between the MS signal and the main magnetic minerals which are interpreted as mostly related to detrital inputs. However, the application of MS on fluvial and lacustrine sediments is still a matter of debate.

In the northwest of China, Cretaceous fluvial and lacustrine sediments are well exposed in different locations, corresponding to different sedimentary basins. These outcrops have the potential to document the different steps of the basin formation, as well as climatic changes through time. This work focuses on the Hekou and Liupanshan Basins located at 250 km apart. The sediments deposited in these two different basins are both from alluvial, fluvial and lacustrine settings. The Lower Cretaceous, Hekou Group in the Hekou basin and Liupanshan Group in the Liupanshan basin, are respectively 3570 and 1330 meters thick, corresponding to 139-106 Ma and 127-100 Ma (magnetostratigraphic dating). Mean mass MS value are respectively 8.65 m³/kg and 7.35 m³/kg, and the mass MS varies between 1.47 and 23.87 m³/kg, and 0.29 and 75.03 m³/kg in the Hekou and Liupanshan basin. For each settings, the mean mass MS values are different and are decreasing from alluvial to shore, shallow lake, (fan) delta and fluvial settings. Furthermore, mean MS also changes with the main lithology, with a decrease from the mudstones to sandstones, limestones and marls.

When comparing the MS profiles from the two basins, they appear very different and so very hard to correlate. In the Liupanshan Group, they are three levels of volcanic ashes, which are corresponding to abnormally high MS values in comparison to the rest of the curve. When removing these three portions with abnormally high values, some similarities are observed between the two sections, mostly in their lower part, showing also high values that we interpret as related to massive input of magnetite from the fast weathering of the granitic basement. Although after this lower portion, the MS curves in the two sections are relatively different and hard to correlate. The rock-magnetic investigation on the origin and nature of the magnetic minerals in the two basins shows that hematite dominates in the Hekou basin but magnetite and maghemite dominates in the Liupanshan basin. The origin and the variation of the amount of these minerals leading to the main changes in magnetic susceptibility are still unknown. Although it seems that as mentioned before, the sedimentary setting as a strong influence on the magnetic susceptibility signals. Furthermore, tectonic deformation also has an influence on the changes of the MS signal.

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Jahr/Year: 2012

Band/Volume: [17](#)

Autor(en)/Author(s): diverse

Artikel/Article: [Magnetic susceptibility of Early Cretaceous sediments from northwest China and its implications. 20-20](#)