Potential and limitations of MCM-41 in dechlorination reactions

COLIN GUTHRIE[1], ERIC REARDON[1], HARTWIG PEEMOELLER[1] AND JOHN VOGAN[2]

[1]University of Waterloo, Waterloo, ON, N2L 3G1 (cpguthri@uwaterloo.ca, ejreardo@uwaterloo.ca, peemoell@uwaterloo.ca)

[2]EnviroMetal Technologies Inc., 745 Bridge St. W., Suite 7, Waterloo, ON, N2V 2G6 (jvogan@eti.ca)

Batch experiments are currently underway to evaluate the potential of using an MCM-41 supported palladium catalyst (Pd/MCM-41) to degrade chlorinated hydrocarbons and other treatment-resistant aqueous contaminants of industrial origins, such as hexamethylphosphoramide. MCM-41 is a mesoporous silicate material possessing an adjustable pore size of between 2 and 10 nm and an extremely high surface area - in excess of 1 000 m^2/g in well-formed samples. Therefore, MCM-41 shows promise for applications in environmental catalysis as it would expose large surface areas of a catalyst grafted to its surface to target chemicals. Early work in our laboratory demonstrated the ability of Pd/MCM-41 to rapidly degrade TCE and its daughter products in hydrogen-saturated deionized water at ambient temperature and pressure. Future work focuses on setting up column experiments to evaluate the long-term performance of Pd/MCM-41 in degrading organic contaminants. The long-term performance is particularly important because of our recent findings that MCM-41 is metastable with respect to other forms of silica, in particular amorphous silica. Thus over the long-term, MCM-41 may recrystallize to less reactive forms of silica and lose its catalytic properties.

Chemical weathering trends and North American freshwater discharge recorded in the western North Atlantic during termination 1

MARCUS GUTJAHR[1,2]*, MARTIN FRANK[1,3], ALEX N. HALLIDAY[4] AND LLOYD D. KEIGWIN[5]

[1]Department of Earth Sciences, ETH Zürich, Switzerland.

[2]Bristol Isotope Group, Department of Earth Sciences, University of Bristol, Queens Road, Bristol BS8 1RJ, UK (*correspondence: Marcus.Gutjahr@bristol.ac.uk)

[3]IfM-GEOMAR, Leibniz Institute of Marine Sciences at the University of Kiel, 24148 Kiel, Germany

[4]Department of Earth Sciences, University of Oxford, Parks Road, Oxford OX1 3PR, UK

[5]WHOI, Woods Hole, MA 02543, U.S.A.

During the Last Glacial Maximum (LGM) much of North America was covered by the >3km-thick Laurentide ice sheet. Throughout the deglaciation it retreated in an assymetric fashion from southwest to northeast, leading to systematic changes in proglacial lake formation, continental runoff and possibly North Atlantic Meridional Overturning Circulation. Enhanced continental runoff has been detected in the marine oxygen isotope records of the Gulf of Mexico prior to 13 kyr BP. However, no corresponding evidence reflecting subsequent discharge to the north and east has been found in the open North Atlantic.

Here we present the first high-resolution records of Pb isotopic variations in North Atlantic Deep Water (NADW) extracted from authigenic Fe-Mn oxyhydroxides in marine sediments from the Blake Ridge. We put these data in context with published NADW ferromanganese crust data, as well as new laser ablation Pb isotope data obtained from a ferromanganese crust from the Blake Plateau tracing the glacial-interglacial Pb isotopic evolution of the Florida Current. The Fe-Mn oxyhydroxide data reveal a striking excursion towards radiogenic values during the Younger Dryas (YD). This trend is a direct function of increased inflow of continentally-derived Pb into the western North Atlantic, supplied by chemical weathering of North American rocks that were freshly exposed during the preceding glacial erosion. The flux of Laurentide-derived Pb did not reach its maximum until the end of the YD. The lack of change recorded in the Florida Current clearly suggests that the pulse of radiogenic Pb was supplied from the North.

The deep western North Atlantic experienced a persistent highly radiogenic Pb flux throughout the first half of the Holocene, which was the result of elevated chemical weathering rates in North America during the early Holocene.