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Resolving the Opal Paradox in the Glacial Eastern Equatorial Pacific: Implications for the Biological Pump of Carbon

L. E. Pichevin1, B. C. Reynolds2, R. S. Ganeshram1, I. Cacho3

(1) School of Geosciences, Grant Institute, University of Edinburgh, West Main Road, EH10 3JW, Edinburgh, UK

laetitia.pichevin@ed.ac.uk, Fax: +44 131 668 3184, Phone: +44 131 650 8547

(2) IGMR, ETH Zürich, Clausiusstrasse 25, CH-8092 Zürich, Switzerland

(3) GRC Geociències Marines, Facultat de Geologia, Universitat de Barcelona C/ Martí Franques s/n 08028 Barcelona, Spain

The modern Eastern Equatorial Pacific (EEP) is a major oceanic source of carbon to the atmosphere and could have potentially played a key role in lowering CO_2 levels during glacial times. However, available records of nutrient supply, carbon export and opal accumulation from the EEP show contradictory trends over the last glacial cycles and hence the efficiency of the biological pump in the area and its role in glacial CO_2draw down remain unclear.

Here we report a new silicon isotope record that shed new lights on the causes of the paradoxically low opal burial rates observed during the Last Glacial Maximum in the area. We propose a new model which reconciles existing records of glacial-interglacial variability in upwelling intensity, nutrient availability, carbon productivity and opal accumulation from the EEP. Specifically, we suggest that the low opal accumulation rates in the glacial EEP is a result of the alleviation of iron limitation during the dustier glacial periods and the consequent decrease in Si:C uptake ratio by diatoms, and does not reflect a decline in rain rate ratio and biological CO_2 pump as suggested previously. Therefore, we argue that the EEP could have been an important contributor for

the reduced atmospheric P_{CO2} during glacial periods.