

Pulses of ocean acidification at the Triassic-Jurassic boundary recorded by boron isotopes

MOLLY TRUDGILL¹, JAMES W. B. RAE¹, JESSICA CRUMPTON-BANKS^{1,2}, MICHAEL VAN MOURIK¹, MARKUS ADLOFF^{3,4}, ANDREA BURKE¹, FRANK CORSETTI⁵, DANIEL DOHERTY⁴, ROSANNA GREENOP¹, WEI-LI HONG⁶, AIVO LEPLAND⁷, ANDREW MCINTYRE¹, NOOR NEIROUKH¹, CATHERINE ROSE¹, MICHA RUHL⁸, DAVID SAUNDERS¹, EVA E. STÜEKEN¹, JOSHUA WEST⁵, ROSS WHITEFORD¹ AND SARAH GREENE⁴

¹University of St Andrews

²National University of Ireland Galway

³University of Bristol

⁴University of Birmingham

⁵University of Southern California

⁶Department of Geological Sciences, Stockholm University

⁷Geological Survey of Norway

⁸Trinity College Dublin

Presenting Author: mdt2@st-andrews.ac.uk

Mass extinctions have repeatedly perturbed the history of life, with ocean acidification often invoked as a potential kill mechanism; however, direct evidence for a link between pH and biodiversity in the geologic past remains limited. In particular, at the end-Triassic mass extinction event preferential extinction of heavily calcified groups, paired with changes in shallow carbonate deposition, hint at acidification as a causal mechanism, but these observations can also result from other factors. Furthermore, depending on the rates of volcanic input and the efficiency of buffering by the carbonate system, volcanic emissions may not necessarily result in appreciable carbonate undersaturation. Here we examine the link between pH and mass extinction events in the rock record, presenting the first pH reconstruction over the Triassic-Jurassic boundary together with evidence from other novel tracers and time periods. These data, generated using the boron isotope composition of well-preserved fossil oyster shells, reveal a pronounced acidification pulse in the aftermath of the end-Triassic extinction, coincident with input of isotopically light carbon and ocean warming. This signal is consistent with ocean acidification caused by pulses of volcanic carbon input from the Central Atlantic Magmatic Province, supporting the hypothesis that ocean acidification was an important component of large igneous province-associated mass extinctions.