Seafloor weathering of Large Igneous Province volcaniclastics as a driver of ocean chemistry

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The role of large igneous province (LIP) emplacement has been invoked as a driver of climate, ecology, and ocean chemistry. One impact of marine LIP emplacement is a complex series of weathering reactions occurring at the seafloor, the cumulative effect of which is difficult to predict. To investigate the impact of sub-seafloor alteration of basalt that weathers from a LIP, we combine sedimentological, geochemical, and mineralogical evidence from drill cores collected on Expedition 392: Agulhas Plateau Cretaceous Climate at site U1580. This site included a ~100 m unit that is interpreted as a porous, green zeolitic clay to sandstone deposited in a depression between two local basement highs on the southern Agulhas Plateau with a basaltic volcaniclastic sediment source. Porewater and sediment geochemical results indicate that the cumulative impact of primary weathering, reverse weathering, and authigenic carbonate formation results in a drawdown of porewater alkalinity, dissolved inorganic carbon, and major elements. Our results indicate that after deposition, this fresh basalt material may have driven changes to carbonate chemistry with potential climate impacts. This sedimentary section provides a unique opportunity to investigate potential impacts and feedbacks that may occur with carbon dioxide removal techniques, such as ocean alkalinity enhancement experiments, that aim to add basalt to the ocean to mitigate anthropogenic carbon emissions.