The origin of the Agulhas Plateau at the African-Southern Ocean gateway:

Planned research on igneous rocks from IODP Exp. 392

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The opening of the Southern Ocean gateways allowed the emergence of the Antarctic Circumpolar Current (ACC), crucial for the onset of global Cenozoic cooling (e.g., Sijp et al., 2014, Glob. Planet. Change 119; Voigt et al., 2013, EPSL 369/370). South of Africa, the opening was associated with the formation of several large igneous provinces (LIPs) including the Mozambique Ridge, Agulhas Plateau and the smaller Northeast Georgia Rise and Maud Rise. Plate tectonic reconstructions imply that the latter two were once part of the much greater Agulhas Plateau and were separated by subsequent rifting (Parsaglia et al., 2008, Geophys. J. Int. 174). It is debated whether and to what extent the emplacement of these large volcanic features obstructed the exchange of water masses between the Atlantic and the Indian Ocean thereby delaying the onset of the ACC.

The Agulhas Plateau was drilled during recent IODP Expedition 392 (Uenzelmann-Neben, Bohaty, Childress, et al., IODP Exp. 392 Preliminary Report, 2022). Igneous rocks were recovered at two sites on the southern part of the plateau (Sites U1579, U1580) and at one site near its northern edge (U1582). Preliminary data indicate that all sites returned tholeiitic basalts, formed by low pressure (shallow magma chamber) fractionation of mainly olivine and plagioclase (as typical for mid-ocean ridge basalts and many LIP lavas).

Upcoming geochemical investigations, including Sr, Nd, Hf, Pb isotope compositions, of the recovered rocks will reveal the nature and source of the magmatism. In particular, we want to address the open question whether the Agulhas Plateau, Northeast Georgia Rise and Maud Rise magmatism can all be attributed to the same magma source and setting (“Greater Agulhas”) to test previous plate tectonic reconstruction models. Additional questions are whether a (deep-sourced?) mantle plume initiated the magmatism and its causal relationship to the regional continental breakup and opening of ocean basins.