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A massive earthquake swarm driven by magmatic intrusion at the Bransfield Strait, Antarctica

Simone Cesca[1], Monica Sugan[2], Łukasz Rudzinski[3], Sanaz Vajedian[4], Peter Niemz[1,5], Simon Plank[6], Gesa Petersen[1], Zhiguo Deng[1], Eleonora Rivalta[7], Alessandro Vuan[2], Milton Percy Plasencia Linares[2], Sebastian Heimann[5], and Torsten Dahm[1,5]

[1]GFZ German Research Centre for Geosciences Potsdam, Section 2.1, Potsdam, Germany (simone.cesca@gfz-potsdam.de)
[2]National Institute of Oceanography and Applied Geophysics – OGS, Italy
[3]Institute of Geophysics, Polish Academy of Sciences, Warszawa, Poland
[4]Missouri University of Science and Technology, Rolla, Missouri, US
[5]Institute of Geosciences, University of Potsdam, Potsdam-Golm, Germany
[6]German Aerospace Center (DLR), Oberpfaffenhofen, Weßling, Germany
[7]University of Bologna, Italy

A swarm of ~85,000 volcano-tectonic earthquakes started in August 2020 at the Bransfield Strait, between the South Shetland Islands and the Antarctic Peninsula. The Bransfield Basin is a unique back-arc basin, where the past active subduction slowed down dramatically ~4 Ma, leaving a small remnant of the former Phoenix plate incorporated in the Antarctic plate. Today there is no clear evidence for recent normal seafloor spreading. Continental crust is thinning to develop oceanic crust and the current extension is either attributed to the Phoenix Block subduction and rollback or to shear between the Scotia and Antarctic plates. The 2020 seismicity occurred close to the Orca submarine volcano, previously considered inactive. Geodetic data reported a transient deformation with up to ~11 cm northwestward displacement over King George Island. We use a wide variety of geophysical data and methods to reveal the complex migration of seismicity, accompanying the intrusion of 0.26-0.56 $km^3$of magma off the Orca seamount at ~20 km depth. Deeper, clustered strike-slip earthquakes mark the magmatic intrusion at depth, while shallower normal faulting events are induced by the growth of a lateral dike, extending ~20 km NE-SW. Seismicity abruptly decreased after the largest Mw 6.0 earthquake, suggesting the magmatic dike lost pressure with the slipping of a large fault and the opening of upward paths. A seafloor eruption is likely, but not confirmed by sea surface roughness or temperature anomalies. The unrest documents episodic magmatic intrusion in the Bransfield Strait and provides unique insights into active continental rifting.