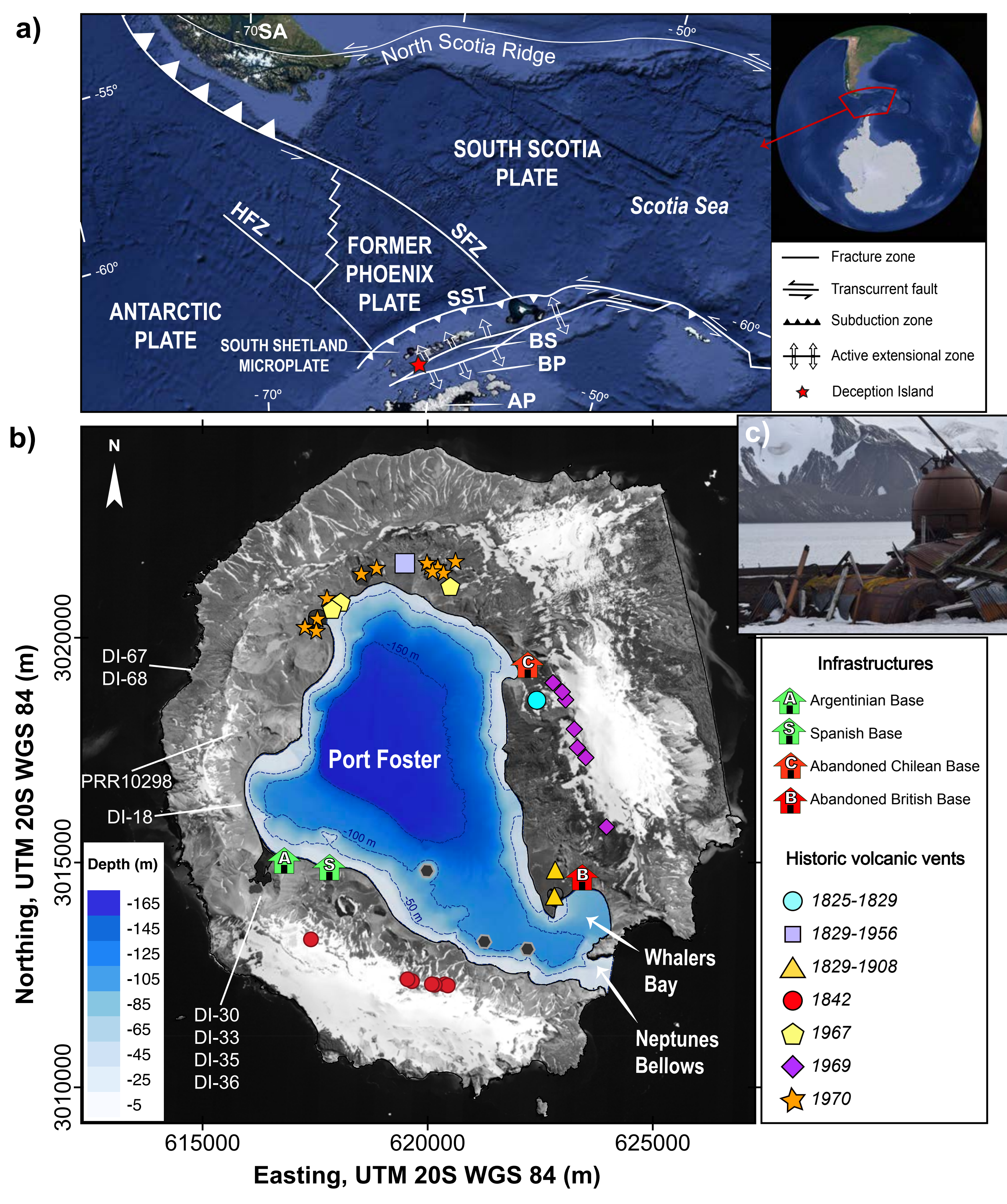


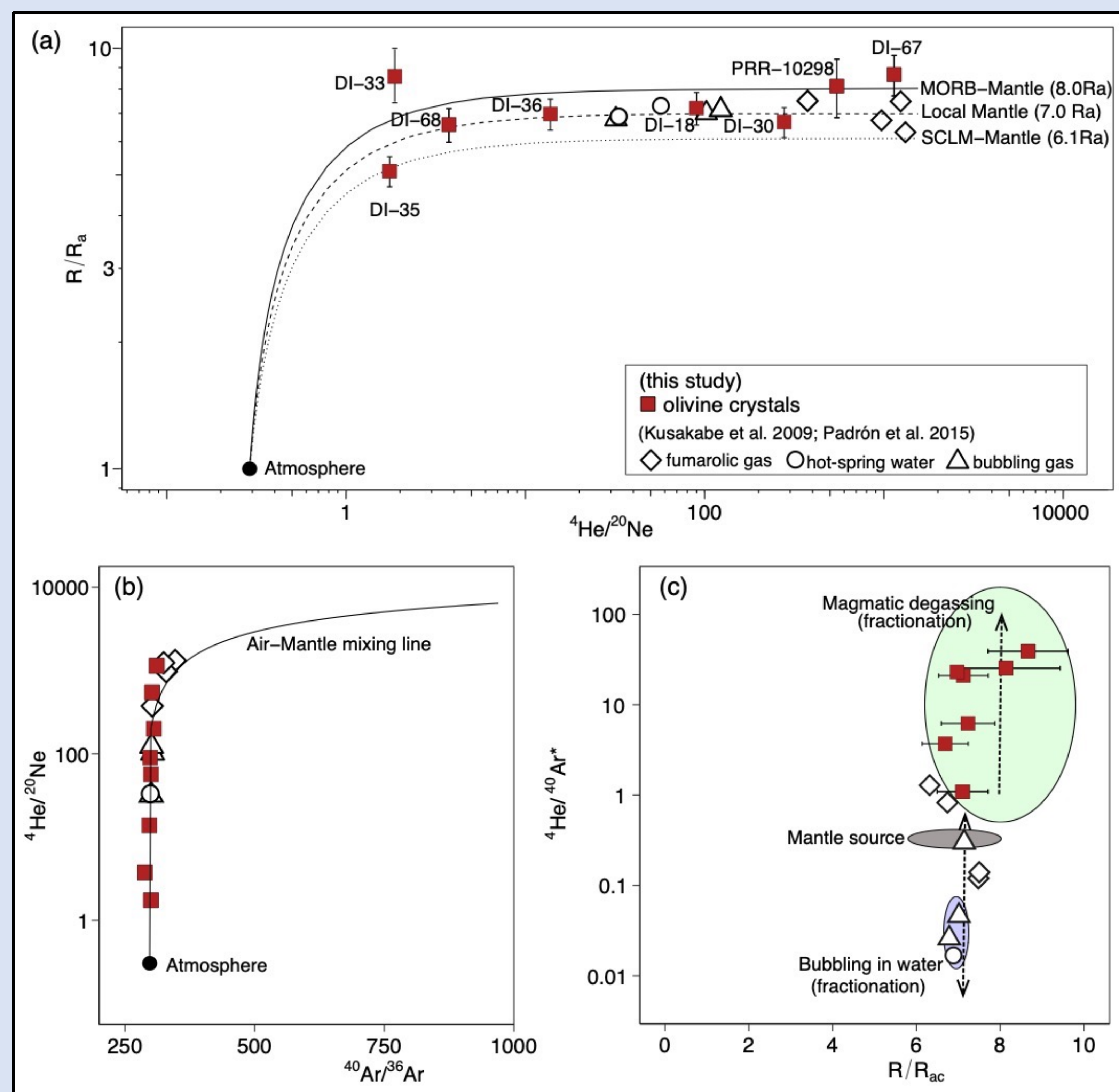
Degassing-derived eruptions at Deception Island (Antarctica): geochemistry of noble gas isotopes with implications for volcano forecasting

Antonio M. Álvarez-Valero ^{1*}, Hirochika Sumino ², Antonio Caracausi ^{1,3}, Antonio Polo Sánchez ¹, Ray Burgess ⁴, Adelina Geyer ⁵, Javier Borrajo ⁶, José A. Lozano Rodríguez ⁷, Helena Albert ⁸, Meritxell Aulinas ⁸, Elena Núñez-Guerrero ¹

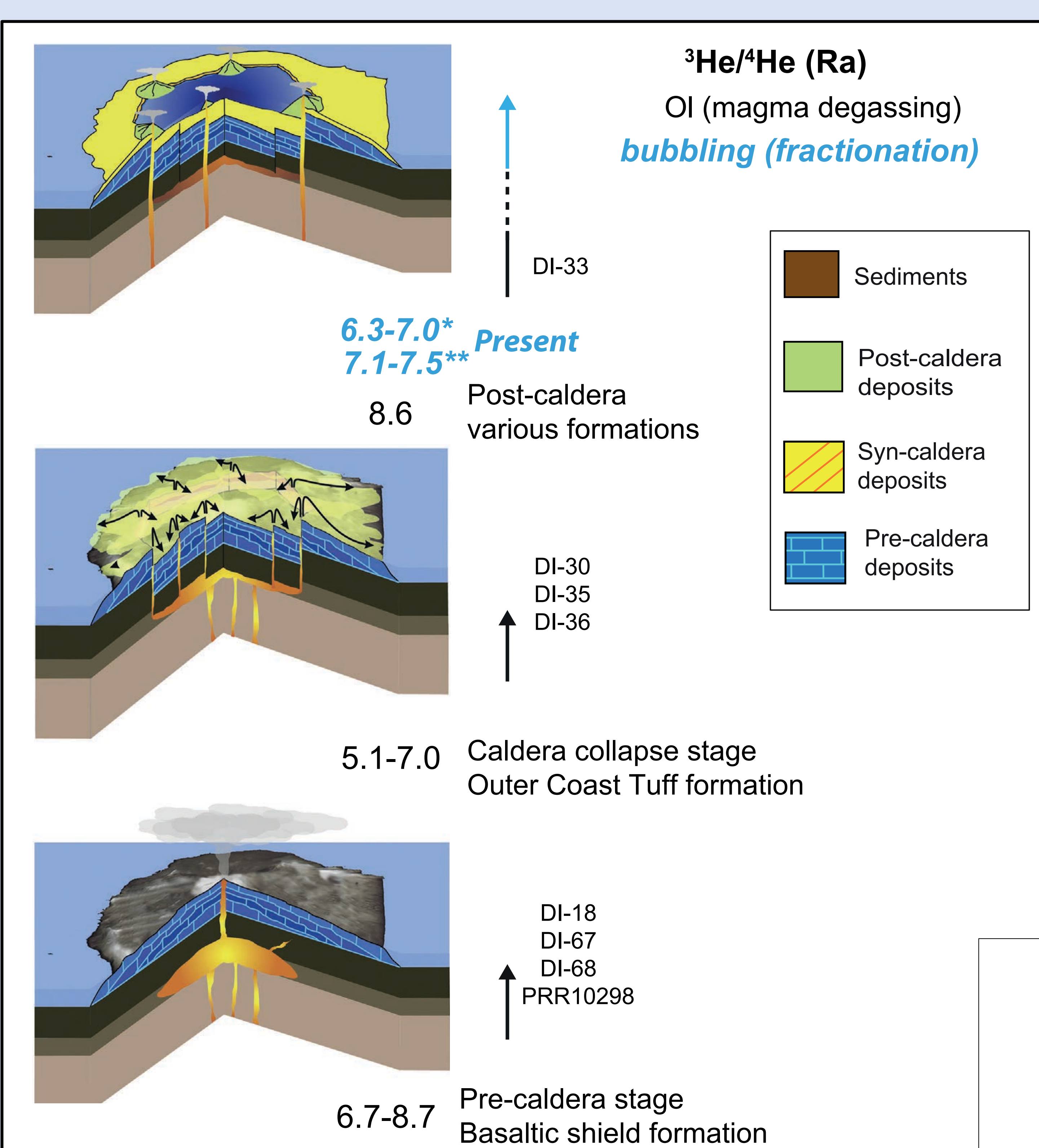
1. Departamento de Geología, Universidad de Salamanca, Spain (aav@usal.es); 2. Research Center for Advanced Science and Technology, University of Tokyo, Japan; 3. Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Palermo, Italy; 4. Department of Earth and Environmental Sciences, University of Manchester, UK; 5. Geosciences Barcelona, CSIC, Barcelona, Spain; 6. Departamento de Física, Ingeniería y Radiología Médica, Universidad de Salamanca, Spain; 7. Instituto Español de Oceanografía, C. O. Canarias, Spain. 8. Departamento de Mineralogía, Petrología y Geología Aplicada, Universidad de Barcelona, Spain.



Deception Island is one of the most active volcanoes in Antarctica with more than twenty explosive eruptions in the past two centuries and characterised by three main episodes: pre-, syn- and post-caldera. The magmatic history of this volcano has been widely studied from the petrologic and geochemical perspectives (Geyer et al. 2019; *Sci.Rep.*). We combined this information with the analysis of helium, neon and argon isotopes measured in inclusions hosted in olivine samples thus offering insights into the processes governing its volcanic history. Our results show that: (i) ascending primitive magmas outgassed volatiles with a MORB-like $^3\text{He}/^4\text{He}$ isotopic signature; and (ii) variations in the helium isotope ratio, as well as intensive degassing evidenced by fractionated $^4\text{He}/^{40}\text{Ar}^*$ values, occurred before the beginning of the main eruptive episodes.



(a) Simplified regional tectonic map and location of the South Shetland Islands, and orthophoto map (b); (c) Example of a recent abandoned scientific base after a post-caldera eruption.



Summary-sketch evolution of the He isotopic ratios along the volcanic history of Deception Island (*: Kusakabe et al. 2009 *Ant.Sci.*; **: Padrón et al. 2015, *Geology*)

At Deception Island, an upcoming volcanic eruption is a serious concern for scientists and tourists, a detriment to marine ecosystems and could have an impact to global oceanographic processes. Yet it is not possible nowadays to carry-out low and high frequency volcanic gas monitoring because of the hard climatic conditions and its remote location.

Our research on the pre-eruptive signals of the volcanic activity at Deception Island contributes to a better understanding of the magmatic dynamics with the potential to improve eruption forecasting.

Álvarez-Valero, A.M., Sumino, H., Caracausi, A., Polo Sánchez, A., Burgess, R., Geyer, A., Borrajo, J., Lozano Rodríguez, J.A., Albert, H., Aulinas, M., Núñez-Guerrero, E., 2022. Noble gas isotopes reveal degassing-derived eruptions at Deception Island (Antarctica): implications for the current high levels of volcanic activity. *Scientific Reports*, 12, 19557.



This research was partially funded by the POSVOLDEC (CTM2016-79617-P) (AEI/FEDER-UE), VOLGASDEC (PGC2018-095693-B-I00) (AEI/FEDER-UE), HYDROCAL (PID2020-114876GB-I00)(MCIN/AEI/10.13039/501100011033) and EruptING (PID2021-127189OB-I00)(MCIN/AEI/10.13039/501100011033/FEDER,UE) projects, the JSPS Invitation Fellowship (S18113) at the University of Tokyo, and the PhD grant "Programa Propio III Universidad de Salamanca co-funded by Banco de Santander". This research is also part of POLARCSIC activities.