Characterization of volcanic ashes in cores from the Bransfield Strait and their correlation with volcanic eruptions from Deception Island, Antarctica.

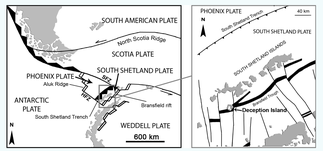
Hopfenblatt, J. (1), Aulinas, M. (1), Geyer, A. (2), Ercilla, G. (3)

(1) Departament de Mineralogia, Petrologia i Geologia Aplicada (Universitat de Barcelona), Martí Franquès s/n 08028 Barcelona, Spain
(2) Institute of Earth Sciences Jaume Almera (ICTJA-CSIC) Luis Solé i Sabaris s/n 08028 Barcelona, Spain. (3) Instituto de Ciencias del Mar (CSIC), Passeig Maritim 37-49, 08003 Barcelona, Spain

joaquinhopfenblatt@gmail.com

1. Introduction & Objectives

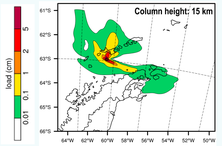
Deception Island (South Shetland Islands) is one of the most active volcanoes in Antarctica, with more than 20 explosive eruptive events registered over the past two centuries[1]. The island is located at the southwestern end of Bransfield Strait, 100 km north of the Antarctic Peninsula.



Simplified regional tectonic map and location of Deception Island[2].

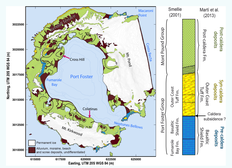
The objectives of this work are the geochemical and morphological characterization of the volcanic ash samples found in marine sediment cores along the Bransfield Strait and establish a potential correlation with volcanic eruptions from Deception Island.

Explosive eruptions in Deception Island tend to generate 5-15 km height eruptive columns that deposit ashes along the Bransfield Strait and over the South Shetland Island's ice cover[4].



Regional-scale model ground deposit thickness (in cm) for the 1970-like scenario with a column height of 15 km[4].

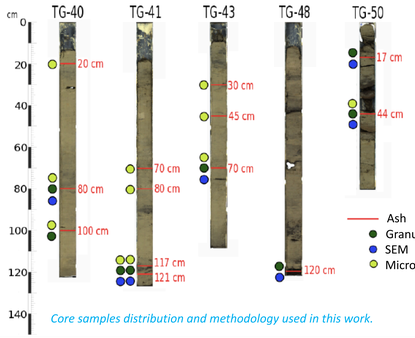
Deception Island's volcanic and magmatic evolution has been strongly marked by the development of a collapse caldera occurred around 4000 years ago[3]. Accordingly, the construction of the island can be separated into three main representative evolutionary stages[1,2]: pre-, syn- and post-caldera.



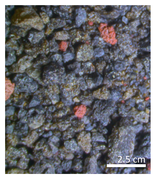
Simplified geologic map and synthetic stratigraphic section of Deception Island[1,2].

2. Bransfield Strait marine sediment cores

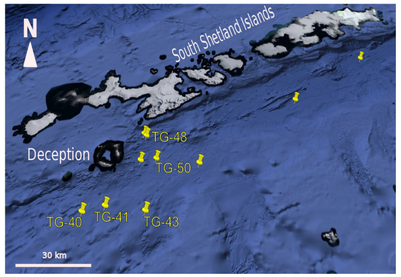
Core samples are located in the Bransfield Strait. In particular, the studied fragments belong to the most proximal cores to Deception Island. Cores correspond to extracted samples under the MAGIA project "*Arquitectura, estratigrafía y sedimentología de los márgenes y cuencas al norte de la Península Antártica*" (ANT-584/97).



Core samples distribution and methodology used in this work.



Tephra sample.

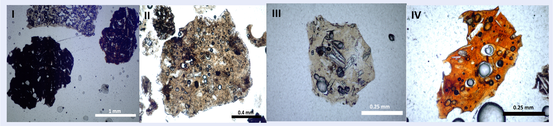


Cores location in Bransfield Strait. (Modified from Google Earth)

3. Results & Discussion

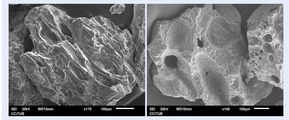
3.1 Petrography & Morphology

Four types of ash fragments are observed. **Type I** shows low contents of plagioclase and olivine microcrysts and a black colored glass. **Type II** include microcrysts of plagioclase, olivine and minor pyroxene and a brown colored glass. **Type III** are formed by phenocrysts of plagioclase, olivine and pyroxene together with a light brown glass. Finally, **type IV** are similar to type III but with a red colored glass.



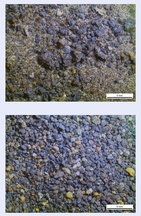
Four different types of ash fragments.

Two types of morphology are distinguished, **blocky** and **curved** described by their planar and curved surfaces, respectively.

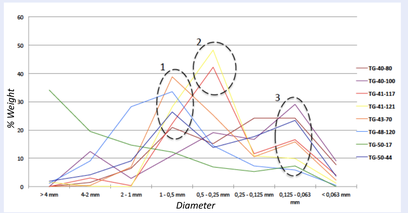


Scanning electron microscope images of two tephra samples.

Particle size distribution in eight selected samples shows three important peaks where grain size vary from **fine ash to lapilli**.

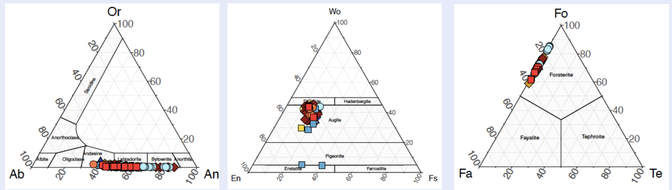


Fine ash to lapilli grain sizes



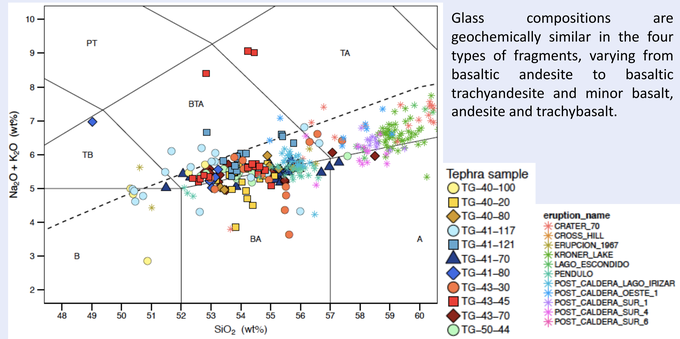
Granulometric analysis graphic.

3.2 Geochemistry & Mineral Phases



Ternary diagrams for the main mineral phases.

Mineral chemistry shows that mineral phase compositions are quite variable. In particular, plagioclases are classified from **andesine to bytownite** with An_{36-86}, pyroxene are mostly **augites** with Wo_{29-42}, En_{39-55}, Fs_{11-21} and **diopside** with Wo_{45-46}, En_{39-41}, Fs_{12-15} and olivines show a wide variety of chemical composition with Fo_{58-85}.



Total Alkali Silica Diagram (TAS). Deception Island composition are represented in colored asterisks[5].

Glass compositions are geochemically similar in the four types of fragments, varying from basaltic andesite to basaltic trachyandesite and minor basalt, andesite and trachybasalt.

4. Conclusions

The results obtained in this study show that mineral phases and glass composition are similar to those displayed by Deception Island's post-caldera rock samples and both exhibit the same magmatic evolution trend.

References

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Acknowledgements

A.G. thanks the support provided by the Ramón y Cajal research program (RYC-2012-11024). This research was partially funded by the MINECO grants VOLCLIMA (CGL2015-72629-EXP) and POSVOLDEC(CTM2016-79617-P)(AEI/FEDER-UE). Analyzed tephra samples and sediment cores were provided by the rock repository of the Instituto de Ciencias del Mar del CSIC (ICM-CSIC) (http://gma.icm.csic.es/ca/dades).