

Olivine- and plagioclase-hosted melt inclusions in Deception Island, Antarctic Peninsula



Yun-Seok Yang^{1,2*}, Jung Hun Seo¹, Sung-Hyun Park², Changkun Park², Seunghee Han², Kye-Hun Park³

¹ Department of Energy Resources Engineering, Inha University, Incheon, Korea (*zinid@kopri.re.kr)

² Department of Polar Earth-System Sciences, Korea Polar Research Institute, Incheon, Korea

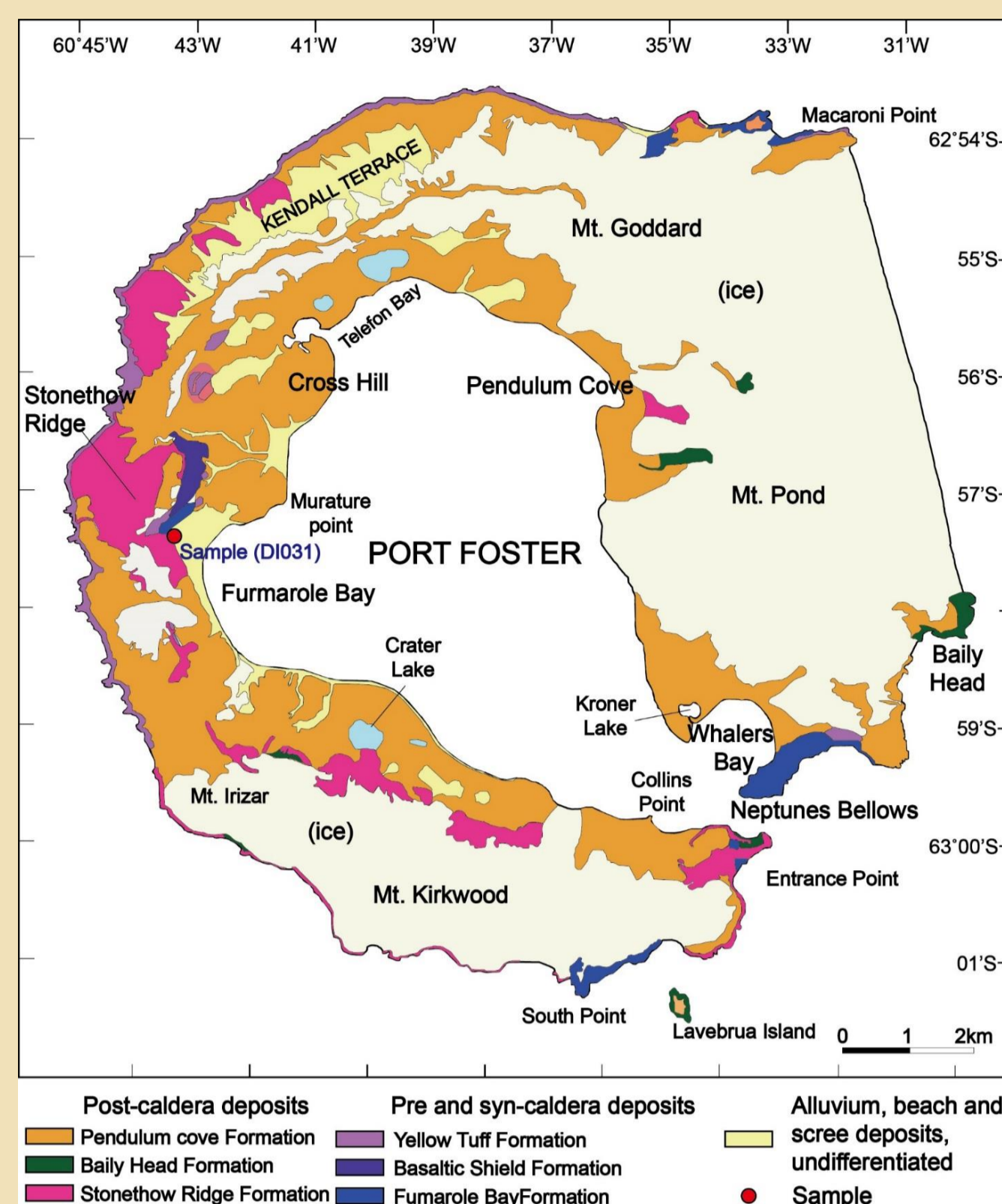
³ Department of Earth and Environmental Sciences, Pukyong National University

Introduction

Bransfield Strait located between Antarctic Peninsula and South Shetland Islands have both characteristics of back-arc and rift (Pankhurst and Smellie, 1983; Machado et al., 2005). Deception Island is located in westernmost part of the Bransfield Strait.

Melt inclusions in phenocrysts of (sub-) volcanic rock provide information about primitive composition and evolution of magma. We studied geochemistry of melt inclusions hosted in olivine and plagioclase in basalts collected from the Deception Island.

Fig 1. Geological map of Deception Island (Smellie and López-Martínez, 2000)



Homogenization of melt inclusion

Olivine- and plagioclase-hosted melt inclusions from Deception island have heterogeneous phases due to its internal crystallization. We homogenized the melt inclusion for subsequent microanalysis such as EPMA, LA-ICP-MS, and SIMS

To prevent oxidation of minerals at high temperature (about 1250°C for 1-2 hours), we flow Ar gas in the furnace. The melt inclusion was subsequently quenched into glassy inclusion.

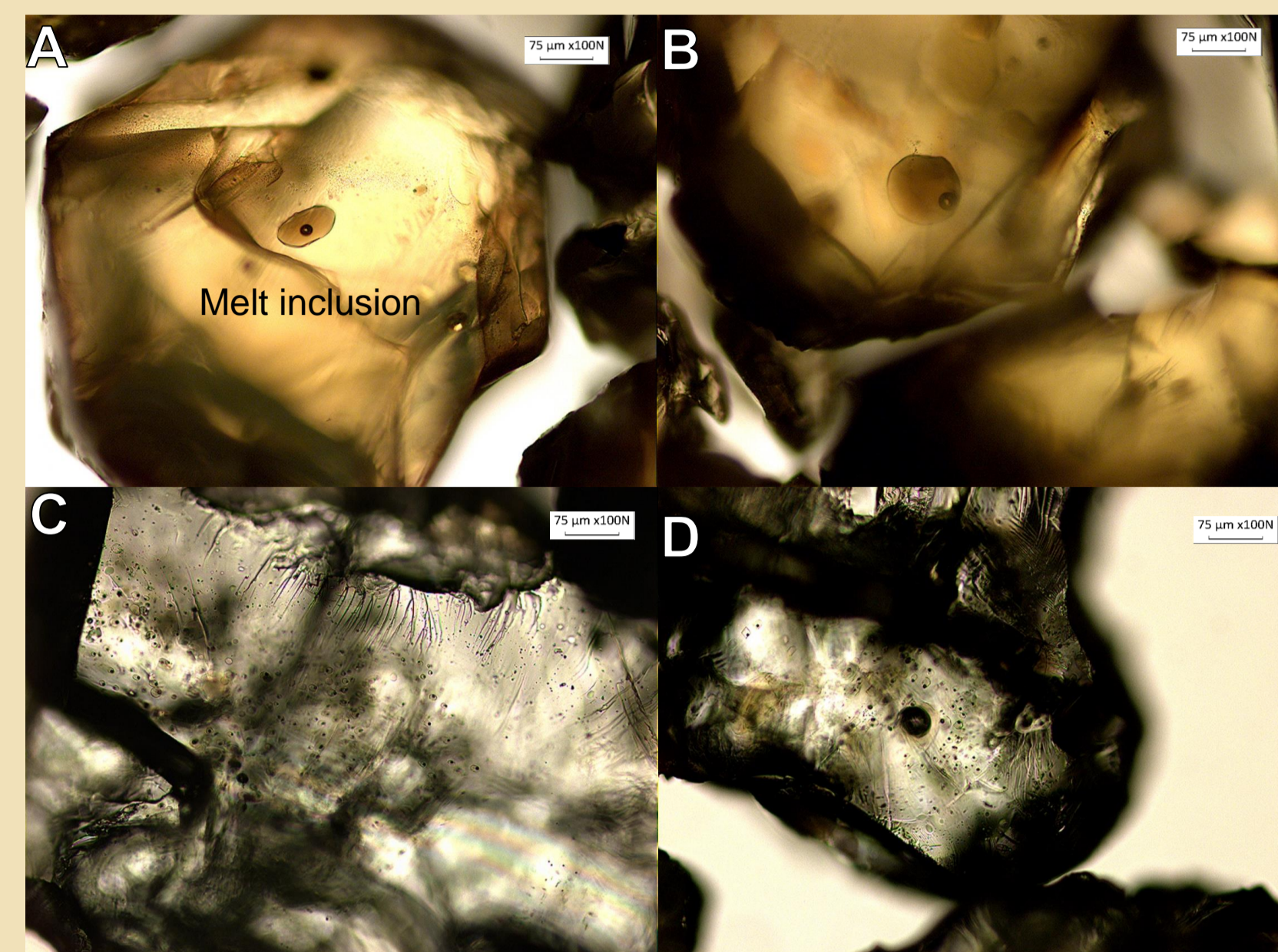


Fig 2. Olivine and plagioclase hosted silicate melt inclusion in basalts from Deception island. A,B: Olivine-hosted melt inclusions; C,D: Plagioclase-hosted melt inclusions

Major elements

Major element in the glassy melt inclusion were analysed by EPMA.

Olivine-hosted melt inclusions are plotted in picro-basalt to basalt and plagioclase-hosted melt inclusion are plotted in basalt to tephrite. Plagioclase-hosted melt inclusions have various alkali concentration compared to olivine-hosted melt inclusion.

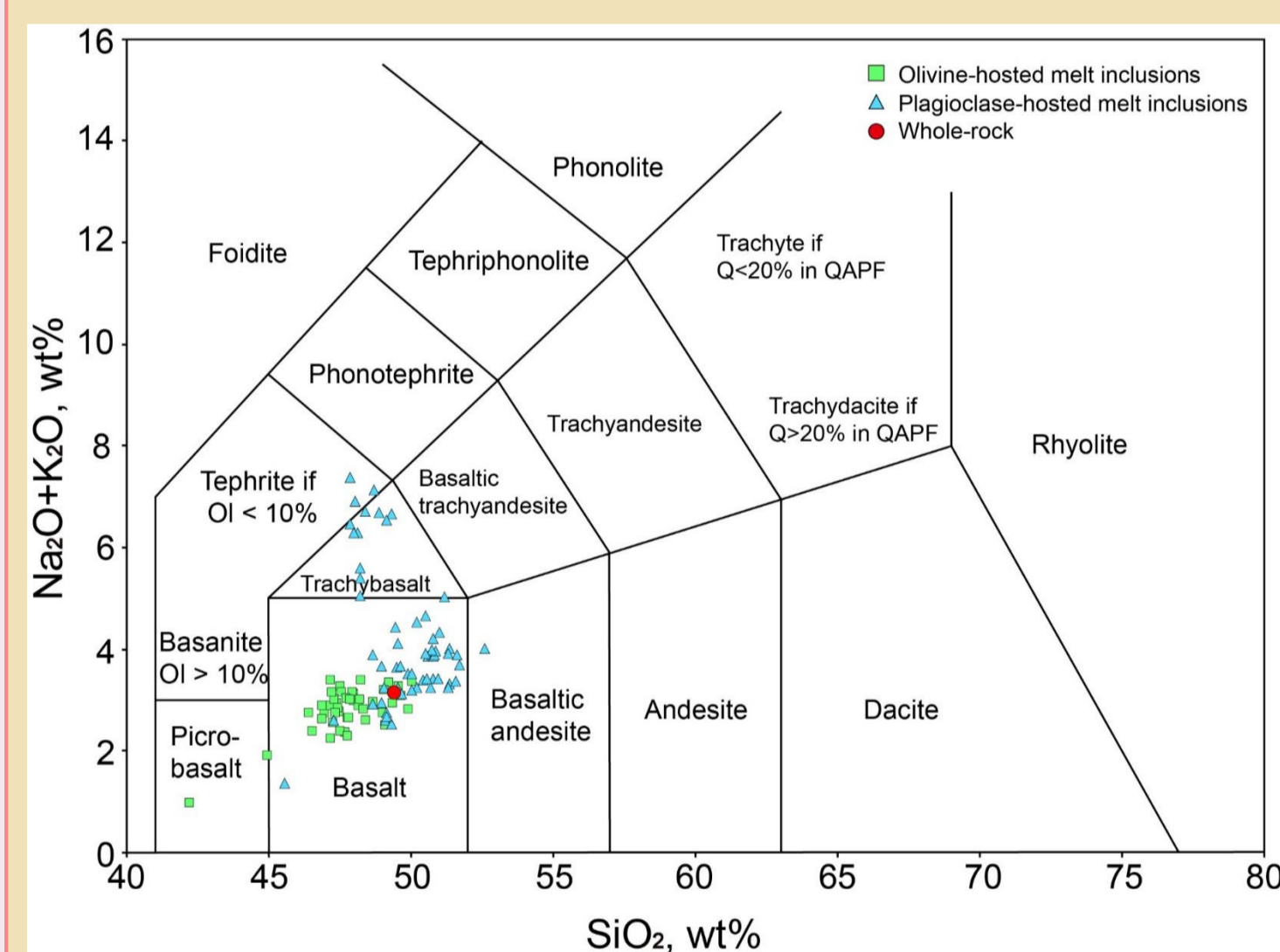


Fig 3. TAS (Total-Alkali-Silica) diagram of olivine- and plagioclase-hosted melt inclusion and whole rock

Trace elements in melt inclusion

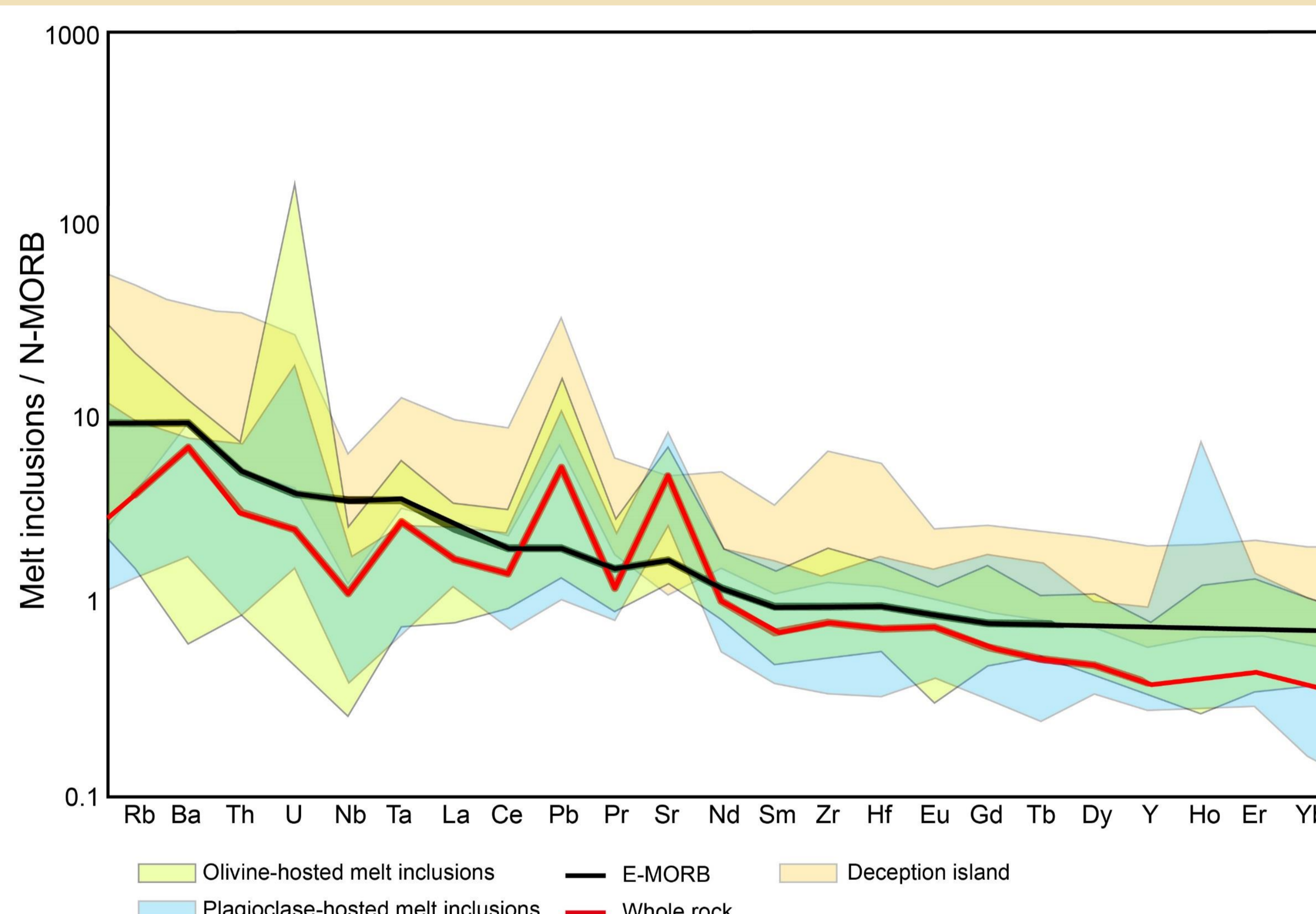


Fig 4. NMORB-normalized multi-element plots of olivine- and plagioclase-hosted melt inclusions. The black line is E-MORB of Sun and McDonough [1989] and the red line is whole rock. Data of trace elements of Deception island rocks from Kye-Hun Park [unpublished]. Concentrations are normalized to N-MORB values of Sun and McDonough [1989].

Melt inclusions contain higher U compared to whole rock composition in Deception island.

Olivine-hosted melt inclusions of high U concentration have also high concentrations of other incompatible elements such as Ba, Ta, Pb, Zr, Hf and HREE as well. This might suggest a fractional crystallization in the magma during trapping of melt in the olivine crystal.

High U olivine-hosted melt inclusions have low Ta and high Nb, Zr, Hf, HREE value, consistent with the composition in the plagioclase-hosted melt inclusions. The high Nb/Ta in arc magma indicate deep arc component, and high Zr, Hf indicate mantle component.

Magma sources

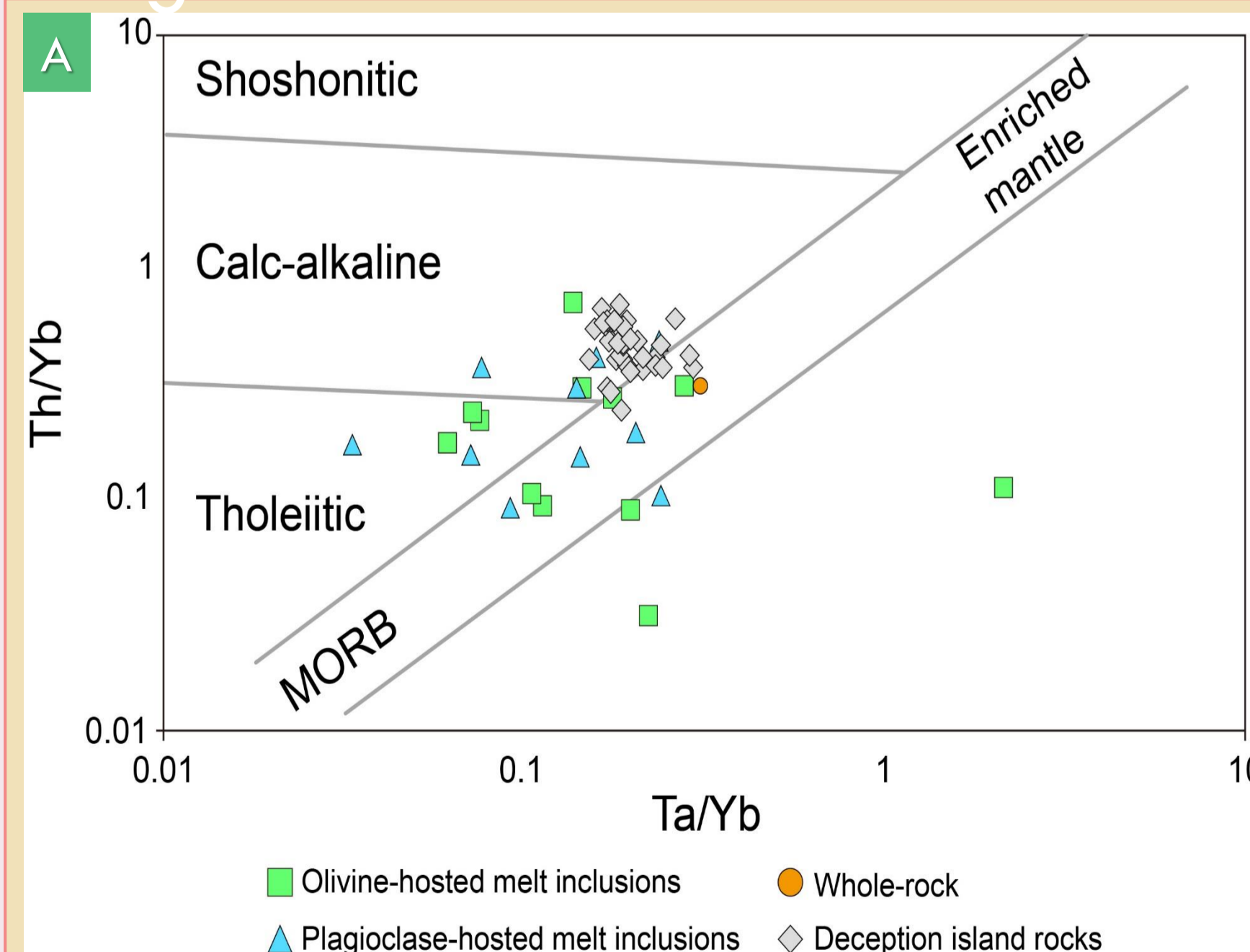


Fig 5. Geochemical classification of melt inclusions and whole rock and Deception rocks (A) Th/Yb versus Ta/Yb discrimination diagram (Pearce et al., 1983); (B) Zr/Y versus Zr discrimination diagram (Pearce et al., 1979).

Whole rock composition of the volcanic rocks in Deception island geochemically belong to calc-alkaline and MORB. On the contrary, composition in melt inclusions indicate diverse tectonic regime (Fig. 5A). Compared to the melt inclusions, whole rock contain higher Th which might indicate a subduction component.

Trace element discrimination among MORB, oceanic arcs and within plate oceanic island (Fig. 5B; Pearce et al., 1979) indicate the whole rock in Deception island belong to within-plate origin. Melt inclusions belongs to all tectonic area as well (Fig. 5B).

High Zr/Y ratio in Deception island rock might be affected by subduction component in continental arc. Trace element composition in olivine- and plagioclase-hosted melt inclusions might indicate diverse source of magma or post-trapping geochemical features of melt inclusion.

Future works

Since some trace elements such as Pb in melt inclusions from Deception island is low, we will prepare bigger melt inclusions larger than 30-50 μm for better detection during later microanalysis including SIMS.

Pb isotope will be determined in the glassy melt inclusion to study melt source and magma evolution

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