

Provenances of ice-rafted detritus in sedimentary core from the Conrad Rise

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Ice-rafted debris (IRD) is a terrigenous material transported within a matrix of ice and deposited in marine sediments when the ice matrix melts (Kuijpers et al., 2014). IRD is one of proxy of glacial variability because both sea ice and iceberg are ice rafting agents. Previous studies suggest that iceberg transports continental materials mainly from Antarctica, while sea ice transports volcanic rocks mainly from island and/or volcano around Antarctica. Therefore, if we determine provenances of IRD, we can estimate Antarctic glacial dynamics. In this study, IRD in sedimentary core (COR-1bPC) from the Conrad Rise were analyzed with Electron Probe Micro Analyzer (EPMA) and their provenances were preliminary estimated.

Based on compositions and mineral stoichiometry, IRD grains were classified into two groups: volcanic glasses including groundmass of volcanic rocks and mineral grains.

Volcanic glasses including groundmass of volcanic rocks: Based on SiO₂-total alkalis classification, these grains have compositions from basalt to rhyolite. Most of grains have similar compositional range to volcanic rocks from the South Sandwich Islands, except for grains with rhyolite compositions. On SiO₂ vs K₂O plot, compositional trend shows low-K series, tholeiitic series to calc-alkaline series, which are recognized for volcanic rocks from the South Sandwich Islands. Compositions of volcanic glasses including groundmass of volcanic rocks reveals that they derived from volcanic islands in the South Sandwich Islands.

Mineral Grains: Volcanic glasses including groundmass of volcanic rocks contains plagioclase, clinopyroxene, and orthopyroxene, corresponding the idea that volcanic glasses derived from volcanic islands in the South Sandwich Islands. Quartz and orthoclase grains are contained in several section. According to the description of volcanic rocks from the South Sandwich Island by Pearce et al. (1995), volcanic rocks including orthoclase were not reported. They also described that “quartz is present as occasional angular xenocrysts in some of the Leskov island andesite and also forms a late interstitial mineral in the dioritic blocks”. If quartz grains derived from the South Sandwich Island, they were only from the Leskov island. Alternate hypothesis is that they derived from continental crust rather than volcanic islands because both quartz and orthoclase are dominant minerals in felsic plutonic rocks and metamorphic rocks. Previous studies reported garnet grains as a line of evidence for continent origin of IRD (e.g., Teitler et al., 2010). Garnet grains were not recognized in this study, suggesting that garnet-free rocks might be distributed at provenance.

Table 1. Mineral and compositions of IRD from Conrad rise.

Sample ID	Depth in core (m)	Quartz	Orthoclase	Plagioclase	clinopyroxene	orthopyroxene
437 RF	4.953	dominant	Or>85	An60-80	Mg#=68	
437 VC	4.953			An80		
507 RF	5.751	dominant	Or>85	An60-70	Mg#=74	
731 RF	8.278			An>85, 60-70, 40	Mg#=46.5, 60-70, 83.9	Mg#=67.8
731 vol	8.278	present		An70-82	Mg#=75	
739 RF	8.369			An60-70, >80, Up to 96	Mg#=68.5	Mg#=70
739 vol	8.369			An 50-66	Mg#=58	
887 RF	10.051	present		An80-90, 53	Mg#=75	Mg#=75
887 vol	10.051			An80-89	Mg#=75	Mg#=70

References

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