Characterization of Glacially Derived Sediments in the Eastern Weddell Sea: $^{40}Ar/^{39}Ar$ Age Distributions of Hornblende Grains

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BACKGROUND

Introduction

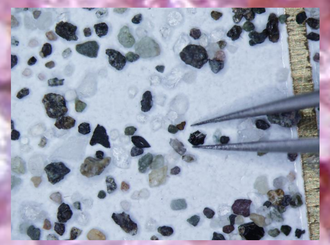
As the current trend of increasing average global temperature continues, it becomes ever more important to understand the current and past dynamics of the Antarctic Ice Sheet. Knowing what changes the ice sheet underwent in the past during temperatures similar to the present gives us a good analog for understanding today's observable Antarctic Ice Sheet dynamics. The purpose of this project is to learn more about the subglacial geology around the Eastern Weddell Sea and to characterize the source areas of glacially derived sediment in an effort to support future work reconstructing past ice sheet dynamics.

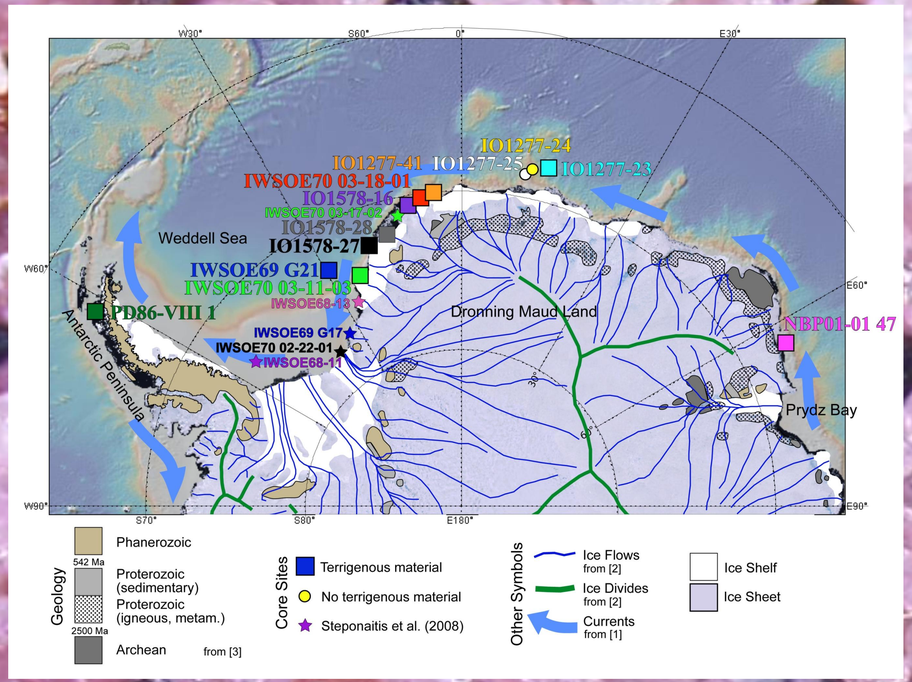
Prior Work

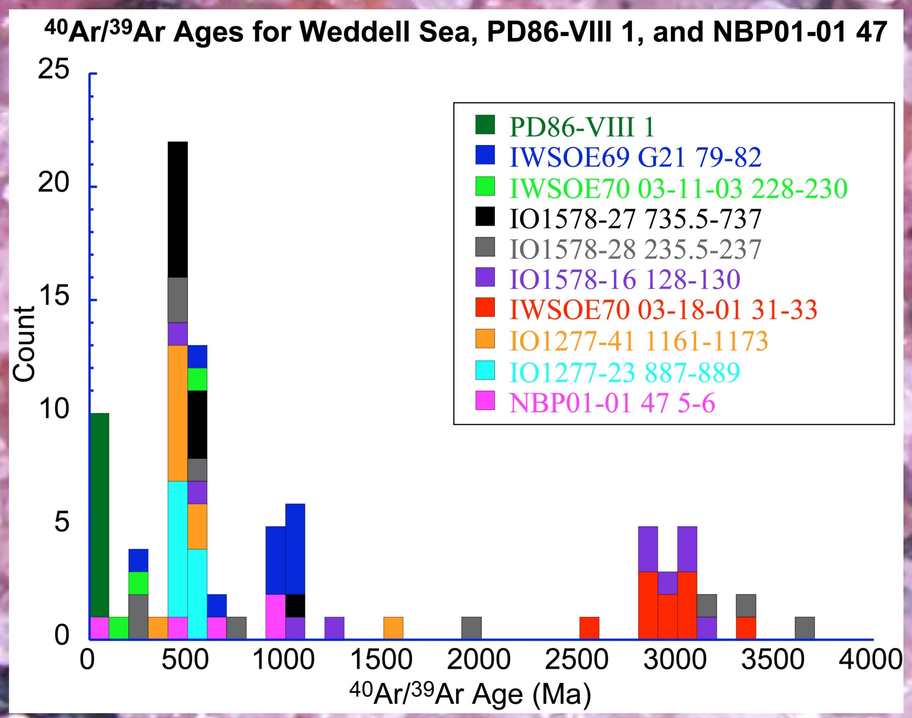
A recent project, Steponaitis et al., (2008), using $^{40}Ar/^{39}Ar$ dating found large age populations of hornblende grains at 500 and 1000 Ma. This project also yielded a significant age population at 3000 Ma.

METHODS AND ANALYSES

•The majority of samples in this study came from piston cores located in the Eastern Weddell Sea and along Dronning Maud Land with one core coming from off the Mawson Coast and another off the coast of Brabant Island along the Antarctic Peninsula
•The samples of sediment were cleaned, disaggregated, and sieved to four size fractions: <63µm, 63-150µm, 150-500µm, and >500µm
•A magnetic separator was used to aid in isolating the hornblende grains
•At least thirty hornblende grains were then picked from the magnetic portion of the 150-500µm fraction
•The hornblendes were then loaded into an aluminum irradiation disk and sent to be irradiated at the USGS TRIGA reactor in Denver, CO
•$^{40}Ar/^{39}Ar$ dating was then performed at the Lamont-Doherty Earth Observatory's Argon Geochronology for the Earth Sciences Lab (AGES Lab)

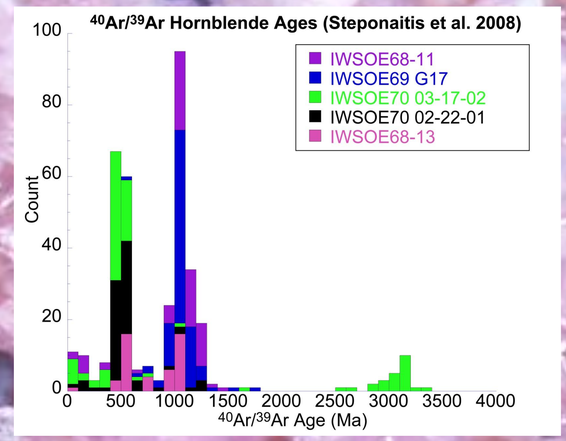






RESULTS

•$^{40}Ar/^{39}Ar$ dating of the hornblende grains from the cores in the Weddell Sea containing a sufficient amount of terrigenous material revealed three age populations of 400-600 Ma, 900-1100 Ma, and 2800-3200 Ma
•Ages from PD86-VIII 1, by Brabant Island along the Western Antarctic Peninsula, showed expectedly young ages of less than 100 Ma
•NBP01-01 47, west of Prydz Bay, had a range of ages from 12-921 Ma



DISCUSSION

•Overall, the $^{40}Ar/^{39}Ar$ ages of the samples agree with the known on-land ages [4,6] and the results of [5], showing age populations that represent three major tectonothermal events in East Antarctica: craton formation with the Humboldt Orogeny (~3000 Ma), Grenville Orogeny (~1000 Ma), and Pan-African Orogeny (~500 Ma)
•One exception to this was a single grain from NBP01-01 47 which yielded a $^{40}Ar/^{39}Ar$ age of 12 Ma and does not match up with known land ages. More grains from this sample will have to be analyzed in the future
•We are in the process of analyzing more hornblende grains from all of these samples with further $^{40}Ar/^{39}Ar$ dating and planning to perform U-Pb dating to more clearly characterize the glacially derived sediment source areas

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REFERENCES

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[2]Barker et al., 2007
[3]Collins and Pisarevsky,2005
[4]Craddock, 1976
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[6]Tingey, 1991

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