To my arrow...

Jake Ross
New Mexico Institute of Mining and Technology
April, 2014

Geochronology of Southern McMurdo Sound and development of a micro laser furnace

by

Jake Ross

Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

New Mexico Institute of Mining and Technology

Socorro, New Mexico

April, 2014

ABSTRACT

Minna Bluff has been a significant topographic barrier to the flow of the Ross Ice Shelf since the mid-Miocene. Detailed Ar-Ar analyses of kaersutite and sanidine phenocrysts, and groundmass concentrates from volcanic units indicate an overall west to east progression of volcanic activity. Eruptions of basaltic to intermediate lavas, domes, and scoria cones started at 12 Ma in at what is now the eastern most point of Minna Bluff, Minna Hook. Activity was centered in this area for 4 Ma, constructing a pre-Minna Bluff island. Multiple glacial unconformities found at Minna Hook suggest repeated interaction with large warm-based, erosive ice sheets. Activity migrated westward from Minna Bluff Island at 7-8 Ma closing the gap created by the island and the mainland. Significant edifice construction continued until 4-5 Ma with sporadic and parasitic scoria cone eruptions, possibly associated with Mt. Discovery activity, continuing until 2 Ma.

The orientations of Minna Bluffs two major axes are strongly controlled by regional tectonic features. Minna Bluffs E-W axis, McIntosh Cliffs, is sub-parallel to the Radial Lineament and the N-S axis, Minna Hook, appears as extension of faulting bounding the Terror Rift. The constructional evolution of the 70km long volcanic complex has an important role in interpreting the climate signals recovered by the ANDRILL Project. Minna Bluff influenced the material delivered to the AND-1B drill site (ANDRILL MIS 2006-2007) in three critical ways: 1) Minna Bluff diverted upstream material, 2) provided

a pinning and stabilizing point for the Ross Ice Shelf, possible controlling the calving line prior to the emergence of Ross Island, and 3) was a significant source of fresh volcanic material throughout much of the period recovered by ANDRILL MIS. For example, a kaersutite-bearing clast recovered from 822.78 mbsf in AND-1B yielded an age of 8.530.51 Ma, and was likely derived from Minna Bluff. The results from this study can be incorporated into detailed glacier and ice-sheet models of the McMurdo Sound region, a critical area in the Ross Ice Sheet and global climate system. Jourdan et al. (2007)

Table 1.

Ar/Ar data and constants used in age calculations.

Sample: NM-791						**Lab #**: 61311			**J**: 4.84E-03 ±8.08E-07				**IC**[1]: 1.000 ±0.0000						
Material: Sanidine						**IGSN**:													
	N	Power	^{40}Ar	^{40}Ar	± 1σ	^{39}Ar	± 1σ	^{38}Ar	± 1σ	^{37}Ar	± 1σ	^{36}Ar	± 1σ	%^{40}Ar*	^{40}Ar*/^{39}Ar$_K$	Age	± 1σ	K/Ca	± 1σ
		(%)		(10^3 fA)		(10^3 fA)							(10^{-2} fA)			(Ma)			
	01	---	0.00100	0.44873	0.13066	0.13846	0.04379	1.74974	0.02651	0.36663	0.02338	0.00181	0.04423	99.6	3.22815	27.99	0.0152	72.88	4.65
				0.00153	*0.12000*	*2.86E-05*	*0.02700*	*-0.00080*	*0.01900*	*0.02530*	*0.01500*	*0.58550*	*0.00037*						
Weighted Mean Age																27.98830	±0.01524		

IC Factor[1]: H1/CDD intercalibration

Constants used

Atmospheric argon ratios

$(^{40}Ar/^{36}Ar)_A$	295.5 ±0.5	Nier (1950)
$(^{40}Ar/^{36}Ar)_A$	295.5 ±0.5	Nier (1950)
$(^{40}Ar/^{38}Ar)_A$	0.188 ±0.5	Nier (1950)
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Interferring isotope production ratios

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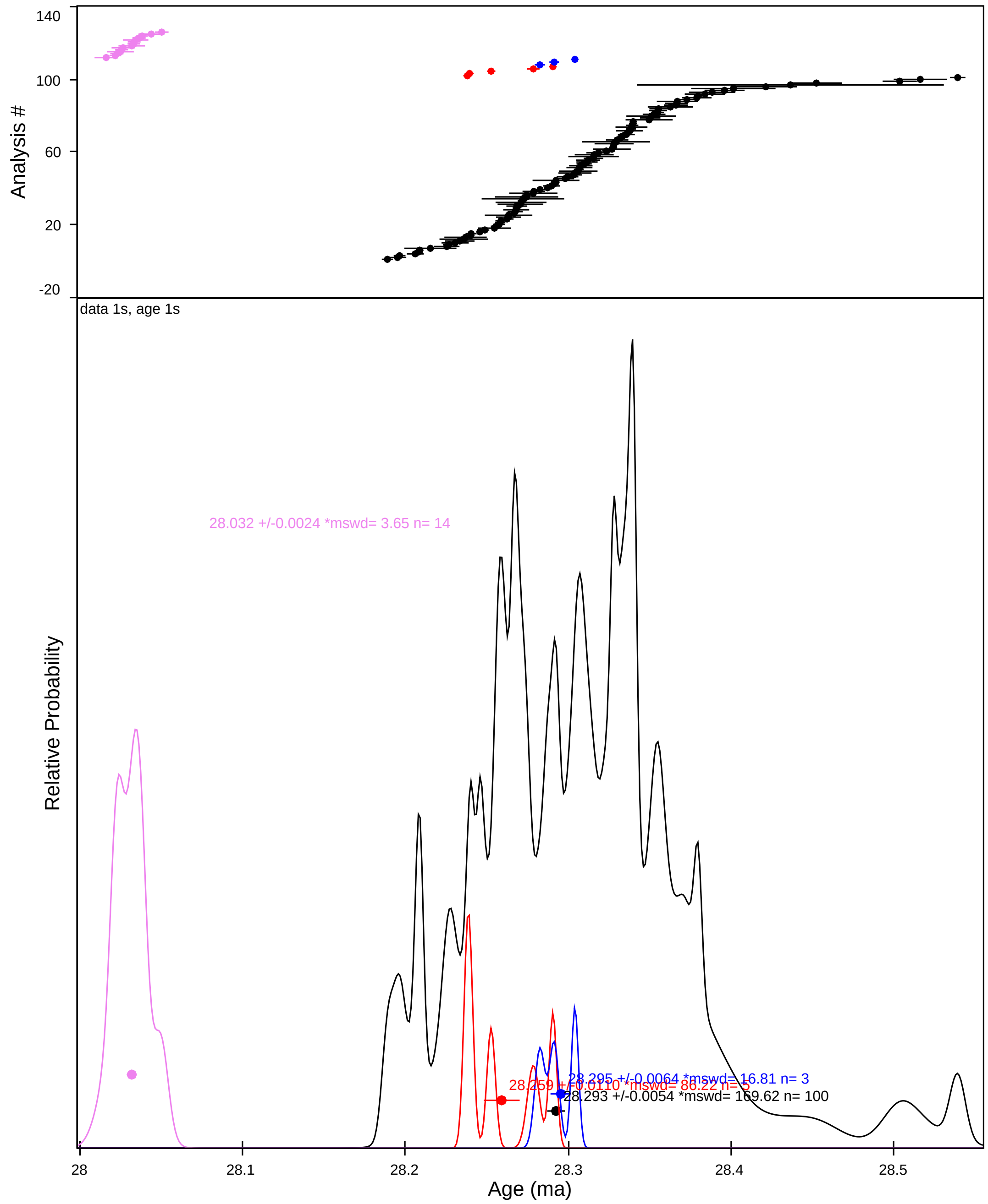

140
100
60
20
-20
Analysis #
data 1s, age 1s
28.032 +/-0.0024 *mswd= 3.65 n= 14
28.295 +/-0.0064 *mswd= 16.81 n= 3
28.259 +/-0.0110 *mswd= 86.22 n= 5
28.293 +/-0.0054 *mswd= 169.62 n= 100
Relative Probability
28
28.1
28.2
28.3
28.4
28.5
Age (ma)

Keywords: A; B; C

ACKNOWLEDGMENTS

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This dissertation was typeset with LaTeX[1] by the author.

[1]The LaTeX document preparation system was developed by Leslie Lamport as a special version of Donald Knuth's TeX program for computer typesetting. TeX is a trademark of the American Mathematical Society. The LaTeX macro package for the New Mexico Institute of Mining and Technology dissertation format was written for the Tech Computer Center by John W. Shipman.

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This dissertation is accepted on behalf of the faculty of the Institute by the following committee:

William C. McIntosh, Advisor

I release this document to the New Mexico Institute of Mining and Technology.

Jake Ross Date

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This section describes the glacial geology of Minna Bluff. Here is the text wrapping around and a displaying a the outer indentation

2.2.2 Glacial

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