Continued Investigation and Correlations of Tephra in the WAIS Divide WDC06A Ice Core

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The WAIS Divide ice core WDC06A continues to reveal a rich tephra record. The "dust bands" distribution, a number of which are now known to represent volcanic ash layers (Fig. 1) was revealed through careful observation by on-site core handlers and subsequent core processing at the National Ice Core Laboratory (NICL) (A. Orsi and others, pers. comm.). In order to improve correlation robustness, significant work has been done on refinement of sample preparation and analysis methods (see Iverson poster, this meeting).

A number of new tephra layers have been analyzed, and new correlations between WDC06A tephra and tephra layers recognized in Siple Dome (SDMA and SDMB), Taylor Dome, and Byrd ice cores, the Mt. Moulton tephra-bearing blue ice area, and source volcanoes have been developed during the past year (Table 1). With analysis of more samples from WDC06A, we now recognize that two eruptions from Mt. Berlin (represented by Mt. Moulton samples BIT151 and BIT152 were actually intervals of volcanic activity that lasted several hundred years each. A deposit from one of these energetic eruptions is recognized on Ross Island, providing a rare link between East and West Antarctica. A number of individual tephra layers within each of these eruptive groups match well, in terms of timing, between WDC06A and SDMA. This long duration of volcanic activity was not previously recognized in near-source deposits from these eruptions, but is evident in the core records. Furthermore, the apparent good match between the two cores suggests that the multiple tephra bands with similar composition resulted from intervals of volcanic activity, not reworking of material.

Age correlations between the WDC06A-06 timescale and timescales from other sources demonstrate excellent agreement. A new correlation between a tephra layer at a depth of 2871.74m in WDC06A and 786.001m in SDMA yields ages of 32463 and 32500 yrs before 1950, respectively. However, other correlations at shallower depths correspond less well. Instances of ambiguous correlations have been observed (see Table 1), and trace element analysis is being used to resolve these ambiguities. A high degree of correspondence is observed between tephra layers observed in the Siple Dome SMDA ice core and those observed in WDC06A, although the latter record appears to contain many more layers, possibly because of the higher accumulation rate and greater proximity to source volcanism.

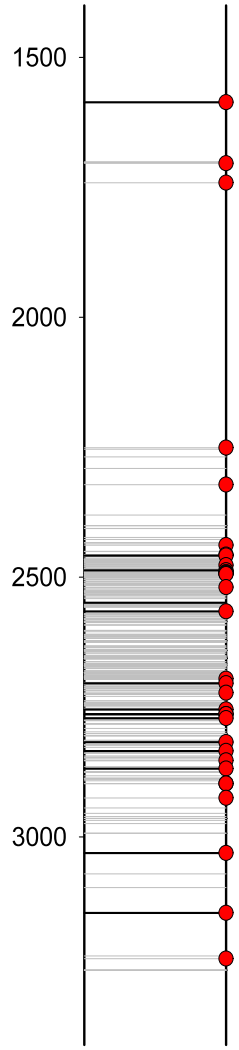

Figure 1. Representation of the WDC06A ice core showing tephra layers. Dark bars represent prominent layers, grey bars represent medium to light layers. Circles on the right-hand axis show sampling depths.

Table 1. **WDC06A layers analyzed to date.** Ages of Siple Dome (SDMA) horizons from Taylor et al., 2004 and Brook et al., 2005; SDMB from K. Taylor, pers. comm.; Taylor Dome from Hawley et al, 2002. Ages of source eruptions are made using the $^{40}Ar/^{39}Ar$ technique, with original ages presented in Wilch et al., 1999 and Dunbar et al., 2008.

WAIS Divide top depth (m)	WDC06A-6 timescale age (yrs before 1950)	Correlation	Correlative age	Source
190.37	702	WDC05-190.810 SDMB-97.2 Taylor Dome 79.155	702 705-710 675±25	Pleiades, East Antarctica
1589.187	8174	SDMA9002 Byrd Core 788m. Source eruption	8166 8200±5400	Mt. Takahe
1706.775	9204	SDMA9001	9237	South America
1744.215	9567	SDMA8004 Source eruption	9429 <10500±2500	 Mt. Berlin BIT150
2325.34	15791	None found		Similar to Mt. Berlin
2441.95	18306	SDMA5540 Source eruption	18200 18200±5400	Mt. Berlin
2461.88	18940			debris
2490.76	19871	SDMA9058, 3027	19100, 19150	Similar to Mt. Takahe
2491.004	19878			debris
2494.256	19985	None found		Similar to Mt. Takahe
2494.259	19985			debris
2569.205	22472	None found		Subglacial eruption
2691.75-2707.735	26434-26910	SDMA5620, 5630, 5635, 5643	26040-27000	Mt. Berlin BIT151
2758.15, 2767.117, 2774.876	28356-28830	SDMA9063, 5683, 5694 Source eruption	28430-28700 27.3±2.3	Mt. Berlin BIT152
2821.070	30442	None found		Similar to Mt. Berlin
2837.880	31089	SDMA5874	31480	Mt. Berlin
2856.100	31856	SDMA5874	31480	Mt. Berlin
2871.74	32463	SDMA9065, 5824	32500, 32530	Similar to Mt. Berlin
2900.67	33635	None found		Similar to Mt. Berlin, and to 2871.74
2928.155	34766	None found		Similar to Mt. Berlin
3034.70	39434	None found		Similar to Mt. Berlin
3149.138	45381	None found		Nearby source, unknown