First (1957-58) Geophysical Investigation of the Filchner-Ronne Ice Shelf

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SUMMARY The only major field project of the U.S. International Geophysical Year (IGY) Antarctic program was aseries of oversnow traverses (Behrendt, 1998; 2003) mostly in West Antarctica, starting in 1957, making seismic reflection ice soundings (and other geophysical measurements) and glaciological measurements. The 1900-km Filchner Ice Shelf (FIS) oversnow traverse mapped snow surface elevation, ice thickness and bed topography of the Filchner-Ronne Ice Shelf (FRIS) area, as well as snow accumulation, the mean annual temperature of that era, and made a geological reconnaissance of the Dufek Massif. Results included the definition of the Thiel trough beneath the FIS and the maximum ice thickness of the southernmost area of the Ronne Ice Shelf (RIS) of 1300 m which is in contrast to 1100-m thickness remeasured by BAS for this area in 1994-95 of only 1100 m suggesting significant melting during the interval.

FILCHNER ICE SHELF TRAVERSE, 1957-58

On 28 October, 1957, our five man party, co-led by Edward Thiel and Hugo Neuberg, left Ellsworth Station on the Filchner ice front with two Sno-Cats (in contrast to the usual three on the other US traverses) each pulling a 2.5-ton sled filled with fuel, food, explosives, (Fig.1) and all of our scientific and other equipment. For the next 81 days we made a geophysical-glaciological reconnaissance of the Filchner-Ronne Ice Shelf area.

The logistics of the traverse oversnow traverse program were dictated by the fact that state-of-the-art electronics at the time depended on the vacuum tube, rather than the solid-state electronic microcircuits available today. The hundreds of tubes in our seismic system required large amounts of battery power. The power requirements, in turn, required two 250 amp-hour batteries weighing 80 kg each to produce the 24 volts necessary for operation. The only recording system was the heavy oscillograph “camera” with its tanks of photographic solutions. Altogether the seismic Sno-Cat carried a total load of about 500 kg of electronic equipment, gravimeter, magnetometer, and seismic batteries. Each Sno-Cat used about 3 liters of fuel per km or about 200 kg for a 50-km day for two vehicles. This fuel determined how frequently we needed resupply by the single-engine Otter aircraft available. These planes could only carry a few barrels of fuel in one trip depending on our range out of Ellsworth.

Although we commonly saw open crevasses on the traverse, the ones that gave us the most trouble were bridged with snow and could not usually be seen from the surface as we drove along (Fig. 2). Sometimes we could safely drive across snow bridges, but other times we broke through. The Sno-Cats were nearly as safe as a man on skis because of their relatively low weight and four wide tracked pontoons. It is much easier to see bridged crevasses from the air, but this method is severely limited, even when a plane is flying directly over crevasses. We traveled in crevasse country most of the 81 days of the traverse and had a number of incidents of vehicles and sleds breaking through. One man fell in about 10 m , but was rescued safely.

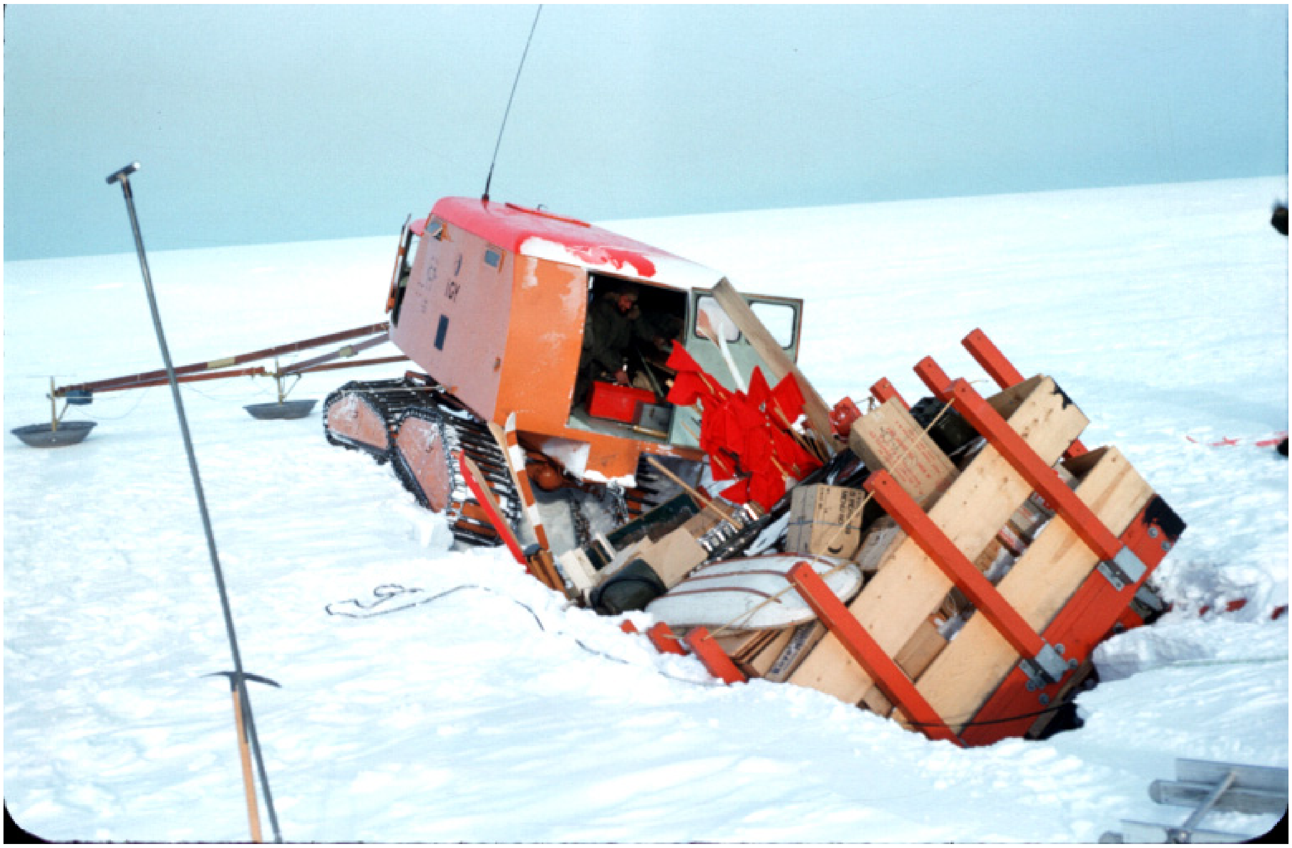

Fig. 2. Sno-Cat and sled broken into hidden, bridged crevasse. Note T-handled probe, ice-axe, and crevasse detector extending forward of Sno-Cat.

CONCLUSIONS

I will discuss results of this first reconnaissance of the FRIS system including the definition of the Thiel trough beneath the FIS and the maximum ice thickness of the southernmost area of the FRIS of 1300 m which is in significant contrast to BAS re-measurement (Johnson and Smith, 1997) of this area in the 1990s of only 1100 m suggesting significant melting during the interval.

REFERENCES

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