Megapackets and Megapseudosynclines in East Antarctica

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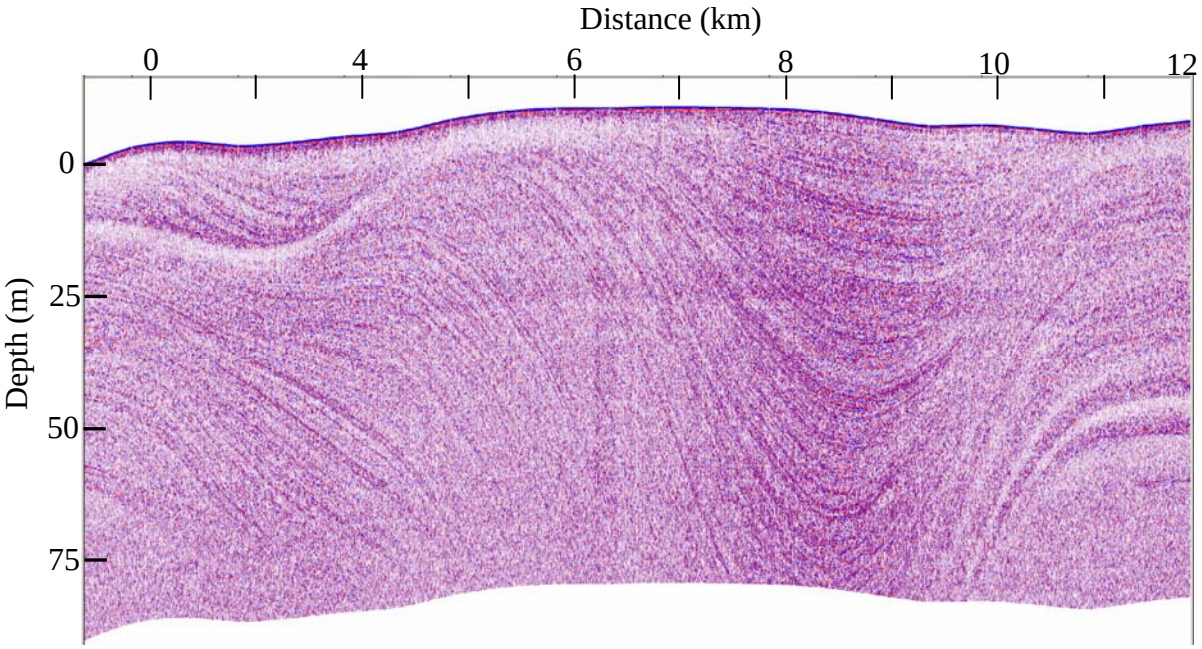
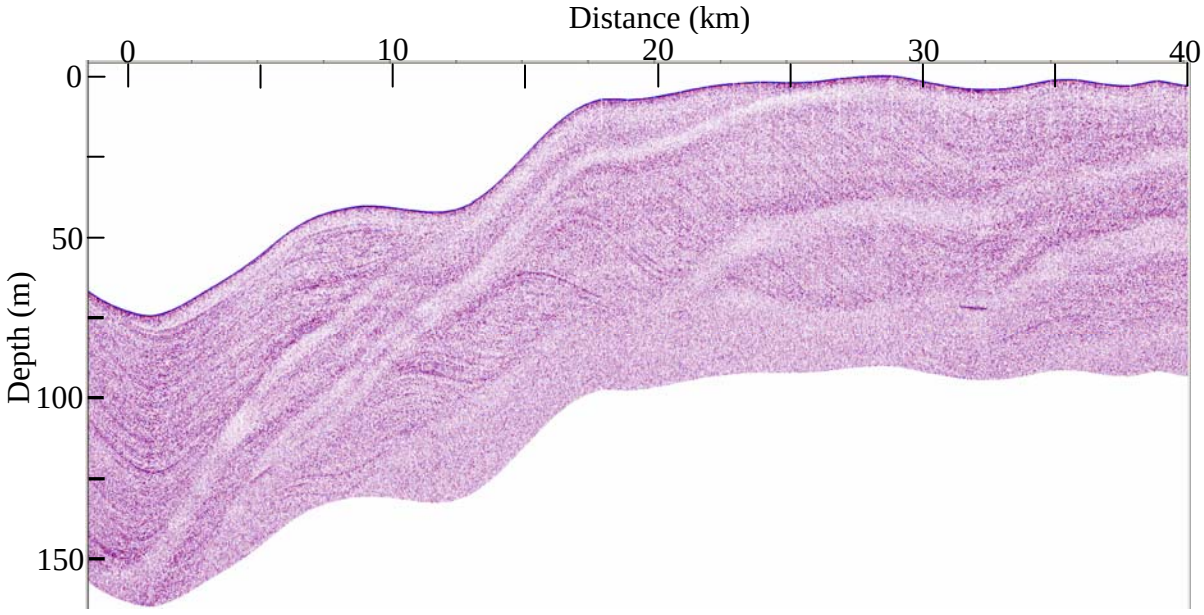
We have used GPR to profile sequential packet formation east of the megadunes region, both on a smaller scale north of Byrd Glacier, and on a much larger, megapacket scale south of it. Packets presently refer to the 8–15 m thick prograding beds sandwiched between 1–4 m thick metamorphic layers previously profiled with GPR in the megadunes region. The metamorphic layers generally grow under glazed surfaces of zero accumulation and are then buried by progradation. Much larger megapackets occur along a 530 km southerly transect, obtained during the 2007 US ITASE program, that started at latitude 81.7 degrees, far west of the Transantarctic Mountains. The first 130 km of this transect was orthogonal to ice flow, along an eastern fringe of the megadunes area, and parallel to dunelike ridges. Along this segment our 90-m deep 200-MHz profile reveals metamorphic layers, one of which may extend 140 km, and an absence of well defined prograded packets, as expected for the transect orientation. For the next 400 km south the transect diverged east from the megadunes to a maximum distance of 220 km. In contrast with the 2–6 km megadune wavelengths and their 8 m maximum amplitudes, along this segment hills are spaced 10 to 30 km, local elevation differences up to 40 m, and packets containing prograding stratigraphy originate from the south-facing windward slopes. Our 4 MHz profile suggests bedrock controls this surface topography. The 200 MHz profile shows sequential metamorphic layers up to 60 km long, with a few clear horizons from buried glaze. In contrast to megadune region packet dimensions, one of several megapackets contains 25 km of prograding beds up to 50 m thick and associated with metamorphic layers up to 15 m thick. Equally spectacular along the entire transect are megapseudosynclines (formed from deposition and not deformation) well over 100 m thick and from which progradation extends north. These features depress and override metamorphic layers. The 4 MHz profile reveals even larger megapackets, including one 250 m thick that reaches more than 1000 m deep, and a 70 km metamorphic unconformity that dips over 200 m. Glaze, underlain by metamorphism, appears to cover about 46% of the entire transect. By 86 degrees latitude, at 530 km, the metamorphic layers fade, and simple layering forms after another 200 km. The 25 km length of prograded deposits must represent extremely high deposition rates, given its concentration at windward faces. The megapseudosynclines should be ideal core sites to obtain deposition history because they lack metamorphic layers. Clearly, packet stratigraphy extends well beyond the megadunes area.



A megapseudosyncline profiled with 200-MHz GPR at the eastern edge of the megadunes area, 81.7^{o} latitude. It is a pseudosyncline because the fold is caused by deposition and not by compression. The bottom of the pseudofold hinge projects to over 150 m deep. The feature is migrating over layers of metamorphosed firn (white streaks) that grew under glazed surfaces.



A megapacket, consisting of prograded beds over 25 km long sandwiched between metamorphic layers. The thickness of these sections is about 90 m.