Letter

Five subglacial lakes and one of Antarctica's thickest ice covers newly determined by radio echo sounding over the Vostok–Dome C region

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Radio echo sounding (RES) measurements were collected from 1995 to 2003 during Italian Antarctic expeditions over the Vostok–Dome C region. The data collected allow for the reconstruction of a bedrock elevation map between the Belgica Highlands and the Aurora Subglacial Basin (112.0°‑124.0° E; 74.0°‑78.0° S). Moreover, analysis of the RES data has revealed one of the thickest ice covers in Antarctica (4755 ± 16 m; 118.321° E, 76.059° S) as well as five new subglacial lakes.

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We present the interpretation of radio echo sounding (RES) measurements collected during 1995, 1999, 2001 and 2003 Italian expeditions in the region between Vostok and the Belgica Subglacial Highlands, East Antarctica (Fig. 1). The 1995 campaign was focused on exploring the Dome C area, the 1999 and 2001 expeditions were dedicated to the area surrounding Lake Vostok and the 2003 survey investigated the Aurora and Vincennes Subglacial Basins and the Belgica Highlands (Tabacco et al. 2002; Forieri et al. 2003).

Data were acquired with a radar system operating at 60 MHz frequency; to locate radar traces a GPS system was coupled to the radar. The bed topography (m WGS84) was obtained by subtracting the ice thickness to the ERS-1 surface elevation (Remy et al. 1999). Figure 2 shows the bed topography and locations of radar data.

During the 1999 survey an ice thickness of about 4750 m (± 16 m, Forieri et. al 2003) was measured. This value is close to the maximum ice thickness (4776 m) hitherto measured in Antarctica, over the Astrolabe Basin (Drewry 1983).

We came back over this profile in 2001 and 2003 surveys to confirm the measurement. The radargrams and the ice thickness sections of the three profiles are shown in Fig. 3. The maximum ice thickness of 4755 m was calculated using a con-
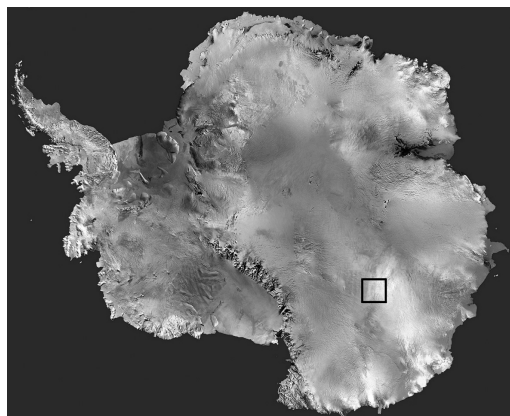
Fig. 1. The location of the surveyed area: the Vostok and Belgica Subglacial Highlands region, East Antarctica.
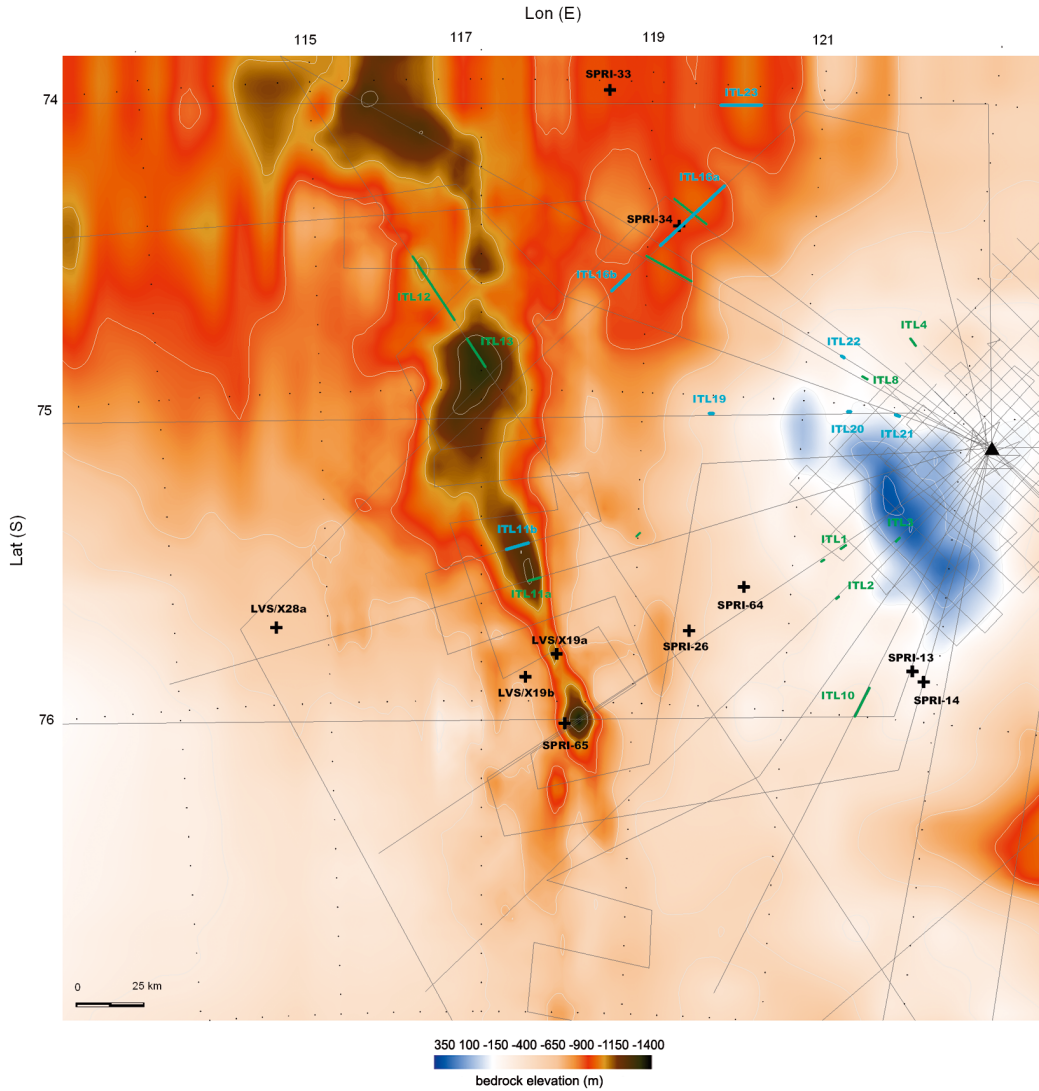
Fig. 2. Two-dimensional contour map (200 m contour interval) of the surveyed area with radar flight locations and subglacial lake positions (green lines for Italian catalogued subglacial lakes, cyan lines for new Italian subglacial lakes, crosses for other lakes). Concordia Station is indicated with a black triangle.

stant value of 168 m/μs as "in-ice" electromagnetic wave velocity (Glen & Paren 1975). Firn correction is considered negligible in these conditions and was therefore not applied.

This point must be counted among the thickest ice coverage ever discovered in Antarctica. Indeed, since ice thickness calculation depends on electromagnetic wave velocity. we would have derived even greater ice thickness values (4768 m and 4785 m) if we had used a value of 168.4 m/μs

(Masolov et al. 2001; Popov et al. 2003) or 169 m/μs (Drewry 1983) in our calculations.

Figure 4 shows ice surface slopes of the investigated area and tracks ascribed to subglacial lakes (thick white lines). The region is characterized by large areas where surface slope is less than 0.5 m/km. Portions of these flat areas are related to the presence of the ice-divide (elongated on the ENE/WSW axis) and, northward, to the Aurora Basin. Table 1 summarizes the positions

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Fig. 3. (a) Thickest ice coverage profiles radargrams. (b) Ice thickness sections with surface elevation.
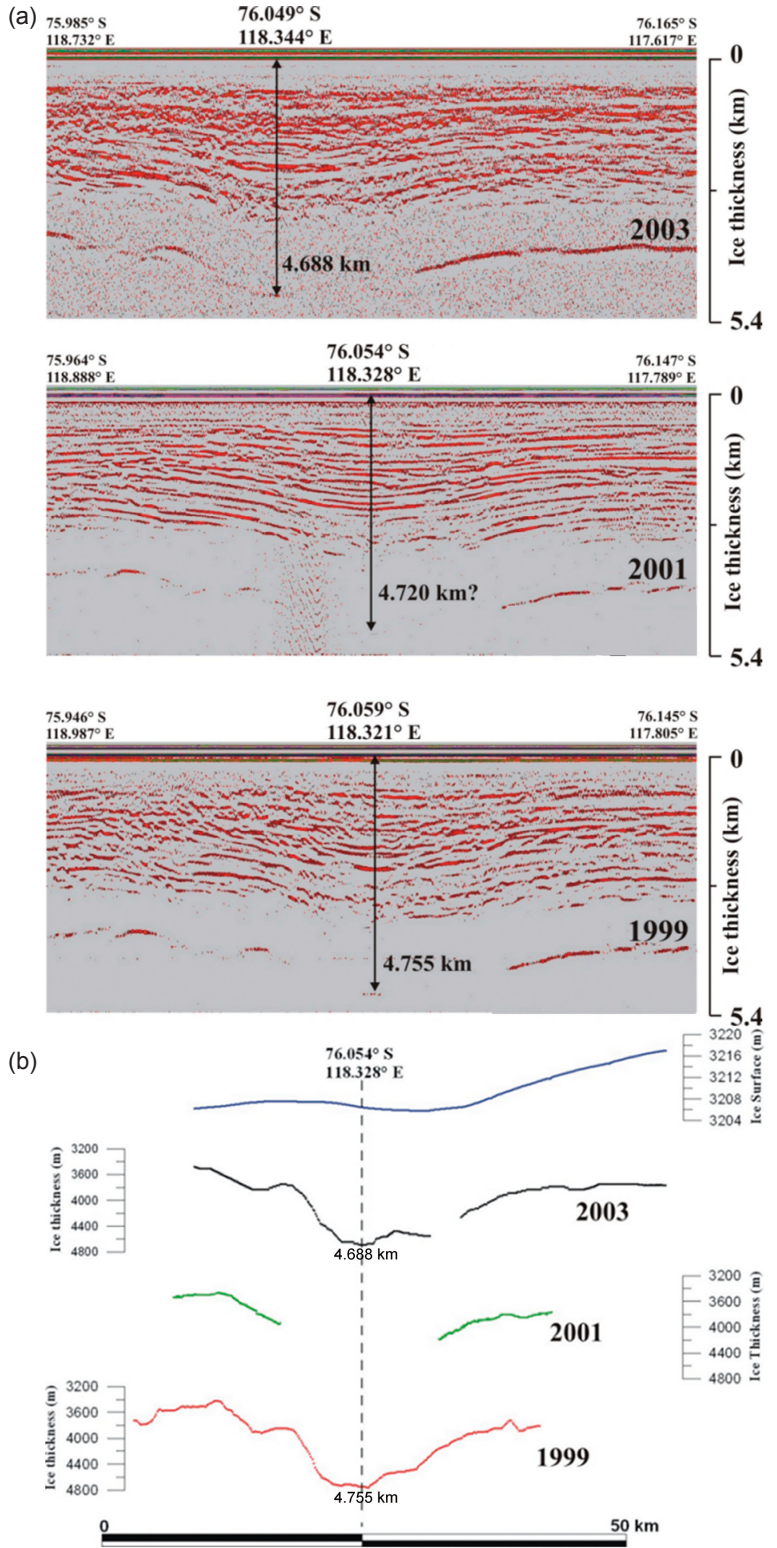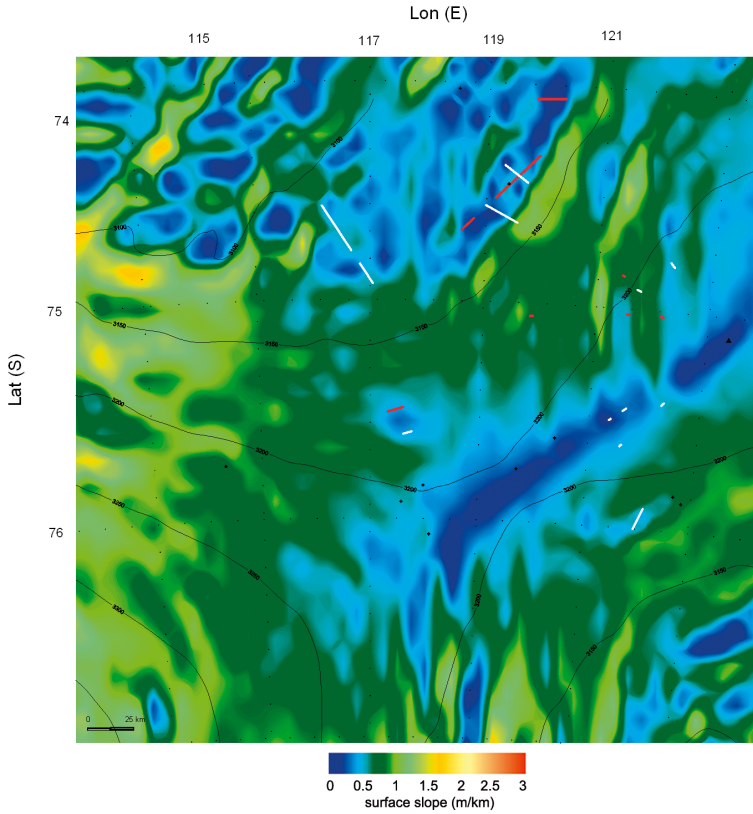
Fig. 4. Surface topography, surface slope and subglacial lakes (50 m contour interval).

and main characteristics of the lakes.

Four lake tracks located in the region of the Belgica Subglacial Highlands have very small dimensions: 1.1, 1.2, 1.5 and 1.3 km. Their ice thickness ranges from 3264 to 3665 m and their elevation from –46 to –491 m. No previously catalogued lakes are close to their positions so they have to be considered as new lakes. In accord-

ance with the Italian inventory classification, we named them ITL19, ITL20, ITL21 and ITL22.

Two lake tracks are indicated in Fig. 4 as ITL16-a and ITL16-b. The former must be considered a new track of the Aurora lake (catalogued as ITL16 and SPRI34), whereas ITL16-b could be either a new lake or an extension of the Aurora lake.

The ITL23 track is probably a new lake. If we

Table 1. Position and main characteristics of the newly reported subglacial lakes. Values refer to the midpoint of the lake tracks.

	Lake id.	Lake length (km)	Lat. (°S)	Lon. (°E)	Ice thickness (m)	Elevation (m WGS84)
Belgica Subglacial Highlands lakes	ITL19	1.1	75.025	121.571	3476	–273
	ITL20	1.2	75.059	119.859	3665	–491
	ITL21	1.5	75.025	122.172	3264	-46
	ITL22	1.0	75.851	121.440	3442	–248
Aurora Basin subglacial lakes	ITL23	14.2	75.063	120.043	4095	–961
	ITL16a	31.1	75.426	119.522	4016	–883
	ITL16b	8.5	75.649	118.685	3953	–819
	ITL11b	5.2	75.499	117.516	4387	–1210

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consider that its ice thickness and elevation are similar to the Aurora lake and that it is located under the same surface slope anomaly, it could also be interpreted as an extension of Aurora. However, in the absence of further data to support for this hypothesis, we have provisionally ascribed this track to a new lake (ITL23). The radar track ITL11-a is an extension of lake ITL11.

To conclude, five lakes have to be added to the revised inventory of Antarctic subglacial lakes (Siegert et al. 2005). This brings to 40 the total number of lakes known in this region.

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