Stable isotope geochemistry of massive ice

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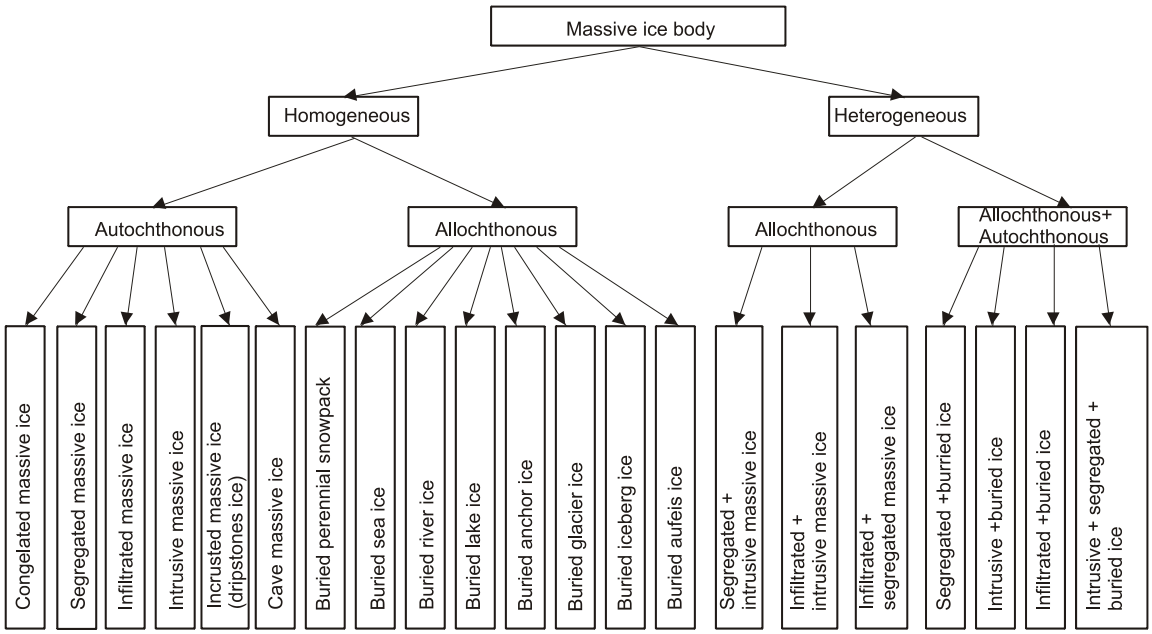

Figure 1 The classification of massive-ice bodies, involving a three-tier system: (tier 1) homogeneous and heterogeneous categories, (tier 2) autochthonous and allochthonous categories, and (tier 3) specific ice types.

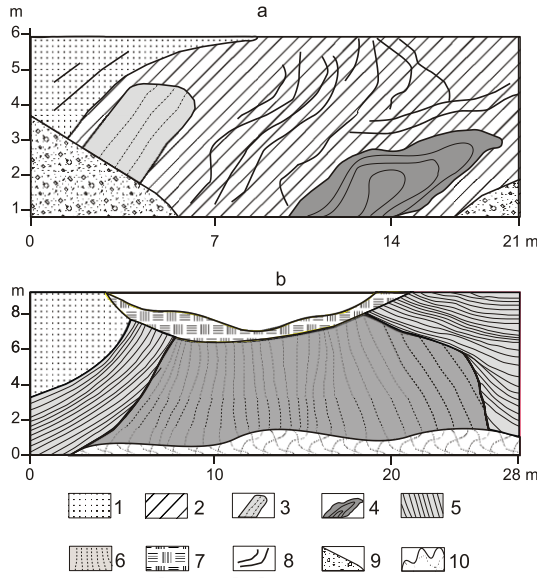

Figure 2 Vertical stratigraphic sections through heterogeneous massive-ice bodies in west Siberia: assemblage of buried and intrusive ice in the upper Yuribey River valley, central Yamal Peninsula (a) and assemblages of segregation and intrusive ice, Erkutayaha River valley, southern Yamal Peninsula (b). 1 – sand; 2 – loam; 3 – layered pure ice; 4 – deformed intrusive ice rich in mineral inclusions; 5 – segregated layered massive ice; 6 – intrusive vertically layered massive ice; 7 – Holocene lacustrine–marsh loam and sandy loam and peat; 8 – laminated sediment; 9 – scree; 10 – slumped material (i.e. debris covering the section)

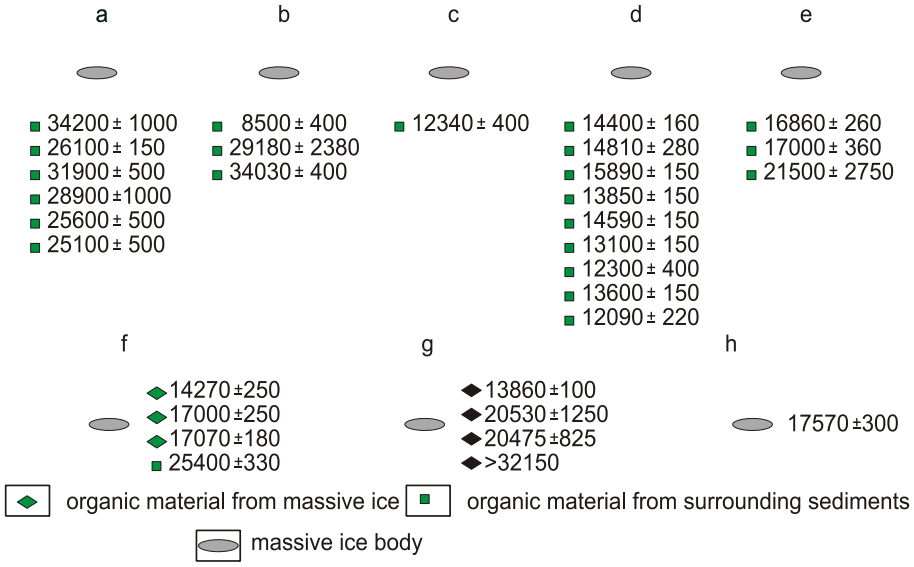

Figure 3. Comparison of the radiocarbon ages of massive ice: a–e obtained by ^{14}C dating of organic material from host sediments surrounding massive ice in Russian permafrost, f–h obtained by direct AMS ^{14}C dating of organic material from ice in Canadian permafrost. Sites: a – Bovanenkovo (Y. K. Vasil'chuk *et al.*, 2009), b – Tyurinto Lake, c – Tab-Salya town, d – Gyda town (Y. K. Vasil'chuk, 1992), e – Tanyurer River valley (Kotov, 1998), f – Peninsula Point (4.5 km southwest of Tuktoyaktuk) (Kato *et al.*, 1988), g – Peninsula Point (Moorman *et al.*, 1998); h – Herschel Island (Moorman *et al.*, 1996).

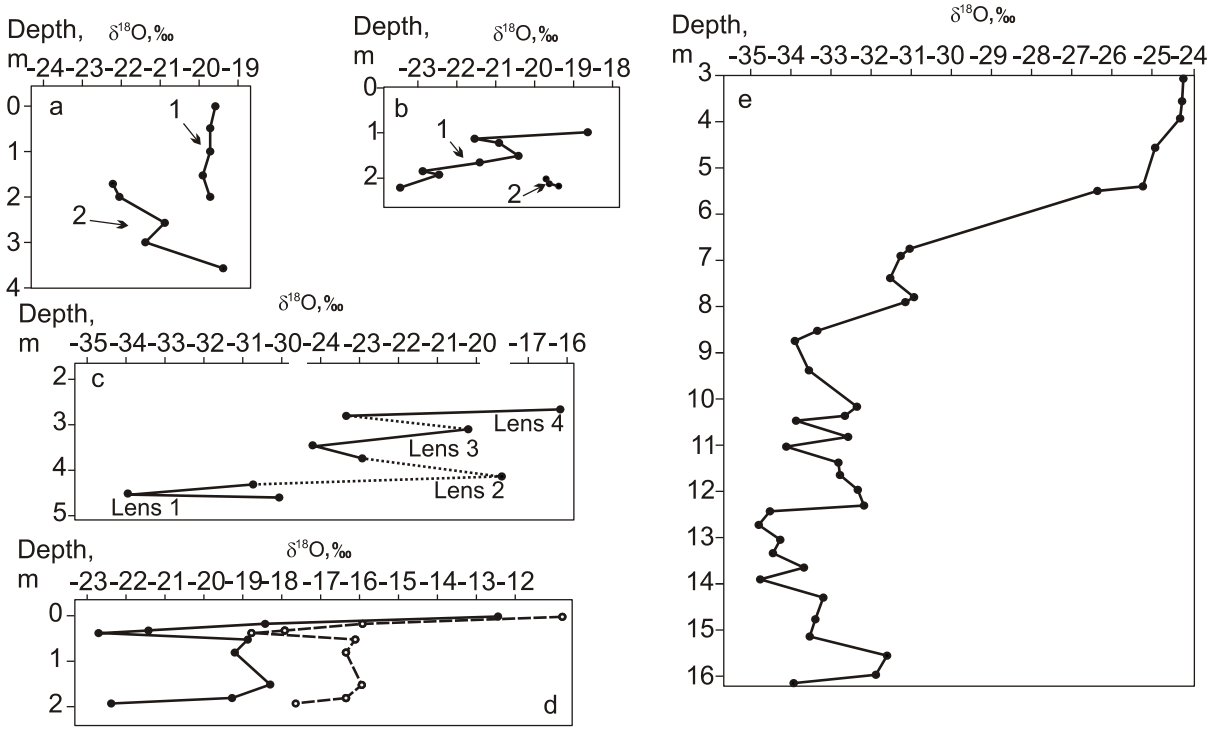

Figure 4 The correlation of oxygen isotope plots of massive ice of Russian (a–d) and Canadian (e) permafrost, formed under closed-system freezing. a–d Yamal Peninsula: a – Erkutayakha (Y. K. Vasil'chuk *et al.*, 2012); b – Kharasavey (Belova, 2012); c – Gyda (Y. K. Vasil'chuk, 1992); d – Bovanenkovo (Y. K. Vasil'chuk *et al.*, 2009); e – borehole 96BGS-06, Contwoyto Lake (Wolfe, 1998).

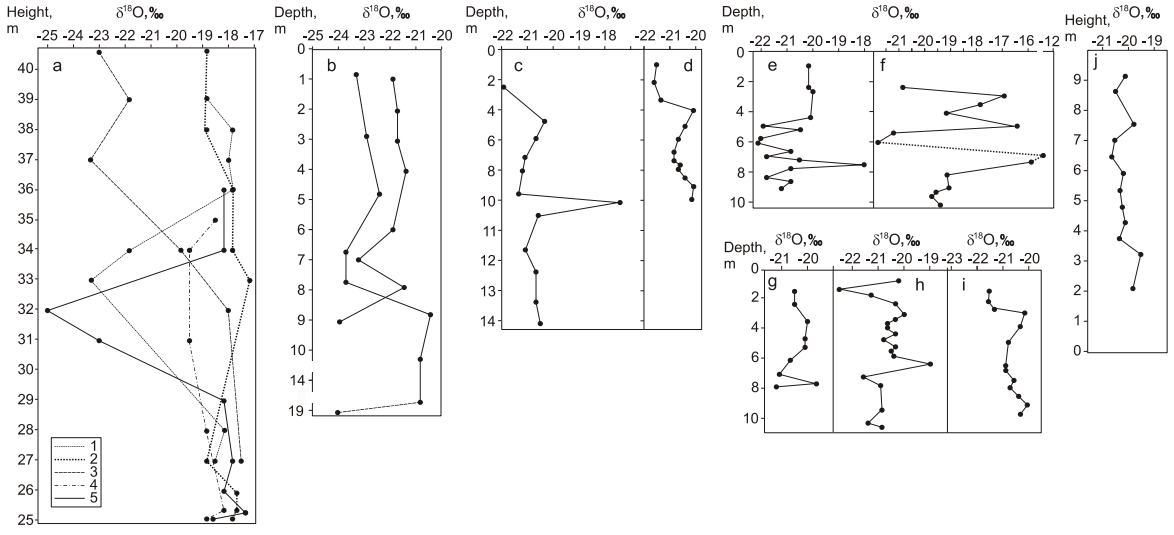

Figure 5 The correlation of oxygen isotope plots of massive ice from Russian permafrost, formed under the open- and closed-system freezing. a – Cape Shpindler on Yugorski Peninsula: 1–5 – different parts of exposure (Ingólfsson and Lokrantz, 2003); b – Yuribey, Gydan Peninsula (Kritsuk, 2010); c – i different parts of the Ledyanaya Gora (or Ice Mountain) exposure, on the right bank of the Yenisey River near the Arctic Circle (Vaikmäe and Karpov, 1986; Vaikmäe and Y. K. Vasil'chuk, 1991); j – Onemen Bay, Chukotka (Kotov, 2001).

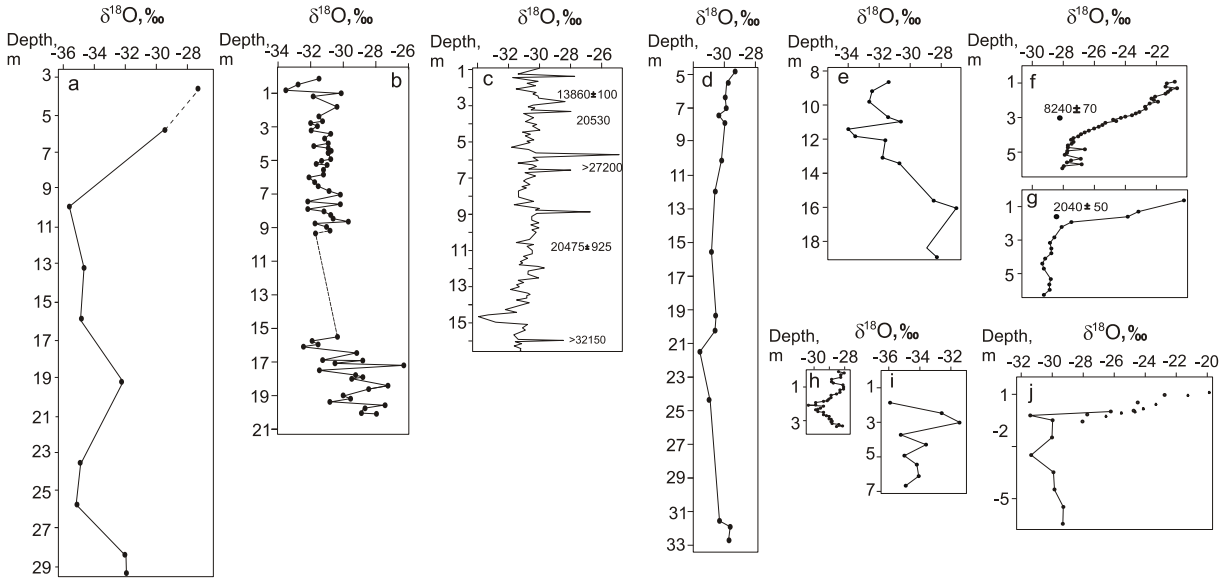

Figure 6 The correlation of oxygen isotope plots of massive ice of Canadian permafrost, formed under open- and closed-system freezing: a – Involuted Hill site, to the northeast of Tuktoyaktuk (Mackay, 1983); b – Peninsula Point (4.5 km southwest of Tuktoyaktuk) (Fujino *et al.*, 1988); c – Peninsula Point (Moorman *et al.,* 1998); d – 7 km to the east of Ya Ya Lake, on southern Richard Island (Dallimore and Wolfe, 1988); e – Lousy Point, near Ya Ya Lake, on southern Richard Island (Dallimore and Wolfe, 1988), f – g Willow River region, Aklavik Plateau, Richardson Mountains: f – profile of site WR-00-5, g – profile of site WR-00-3 (Lacelle *et al.*, 2004); h – 5 km southwest of Tuktoyaktuk (Kato and Fujino, 1981); i – southern Eskimo Lakes region, Tuktoyaktuk Coastlands (French and Harry, 1990), j –Crumbling Point, Summer Island, Tuktoyaktuk Coastlands (Murton *et al.*, 2005).