SUPPORTING INFORMATION

Supporting Figures

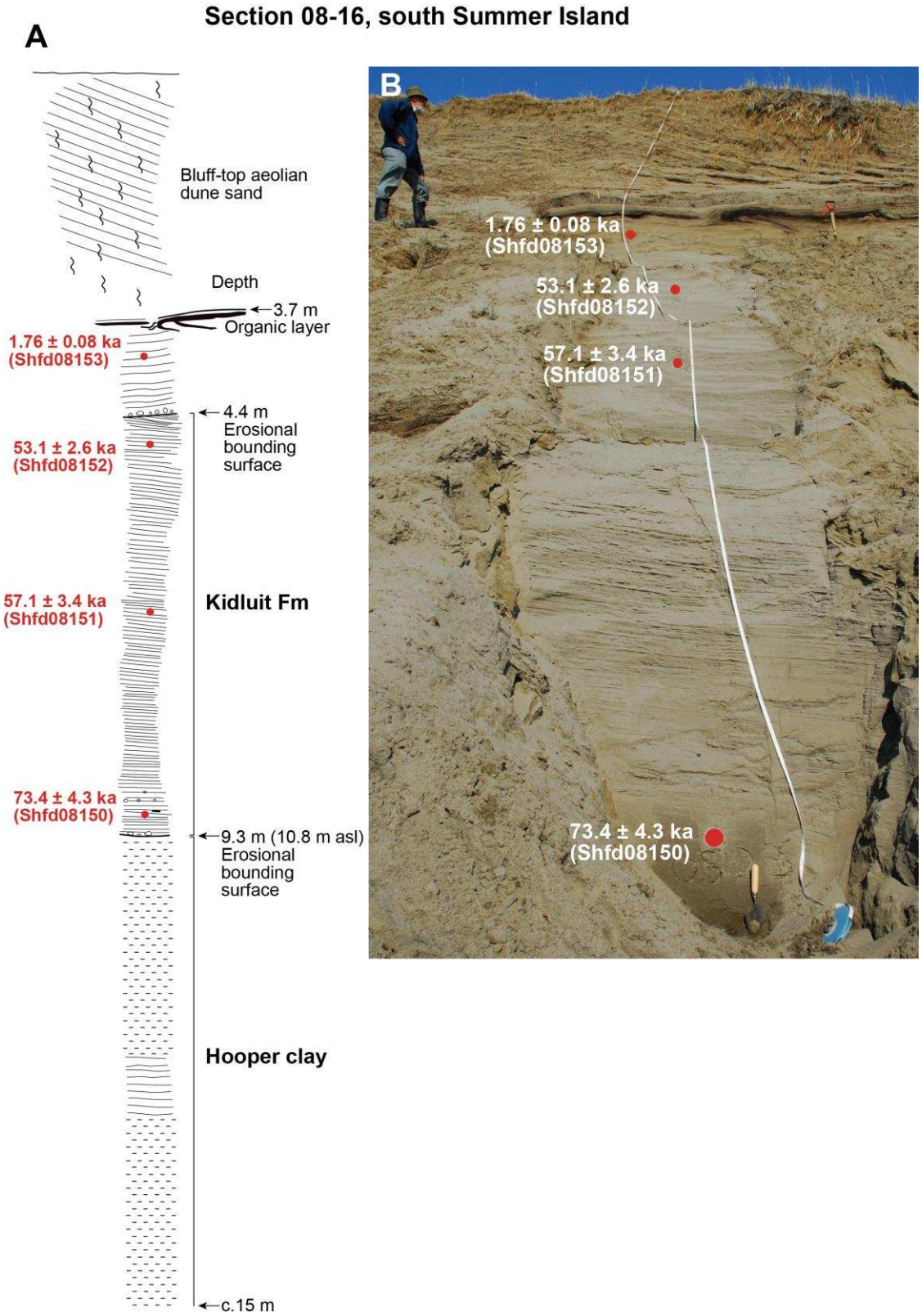

Figure S1 Kidluit Formation overlain by bluff-top aeolian sand in section 08-16, south coast of Summer Island. (A) Stratigraphy and OSL ages. (B) Photograph of section, with Hooper clay (grey) at base of trowel. Hooper clay extended down to at least 15 m depth. asl = Above sea level.

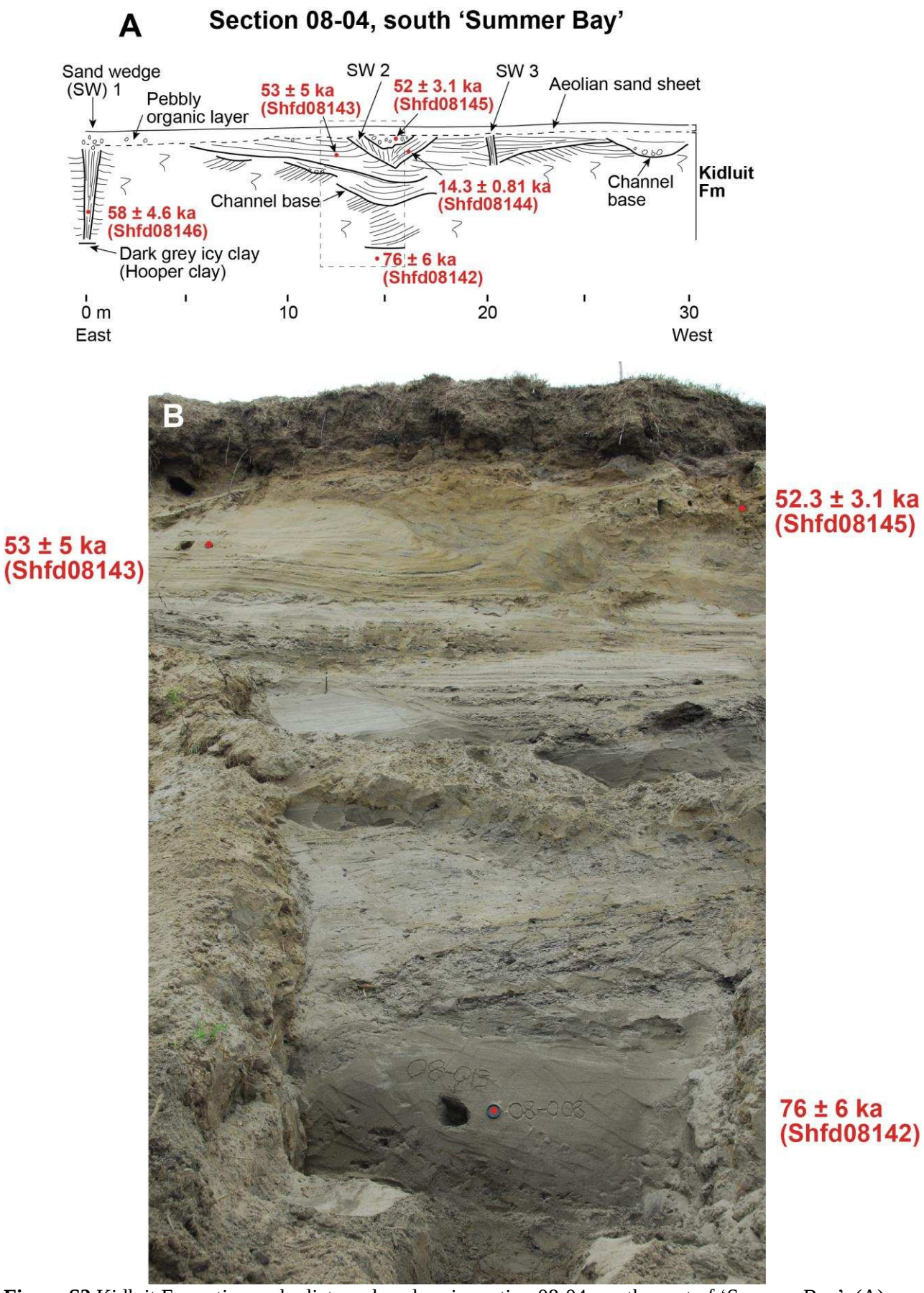

Figure S2 Kidluit Formation and relict sand wedges in section 08-04, south coast of 'Summer Bay'. (A) Stratigraphy and OSL ages. (B) Photograph of section indicated by dashed box in (A). SW = sand wedge.

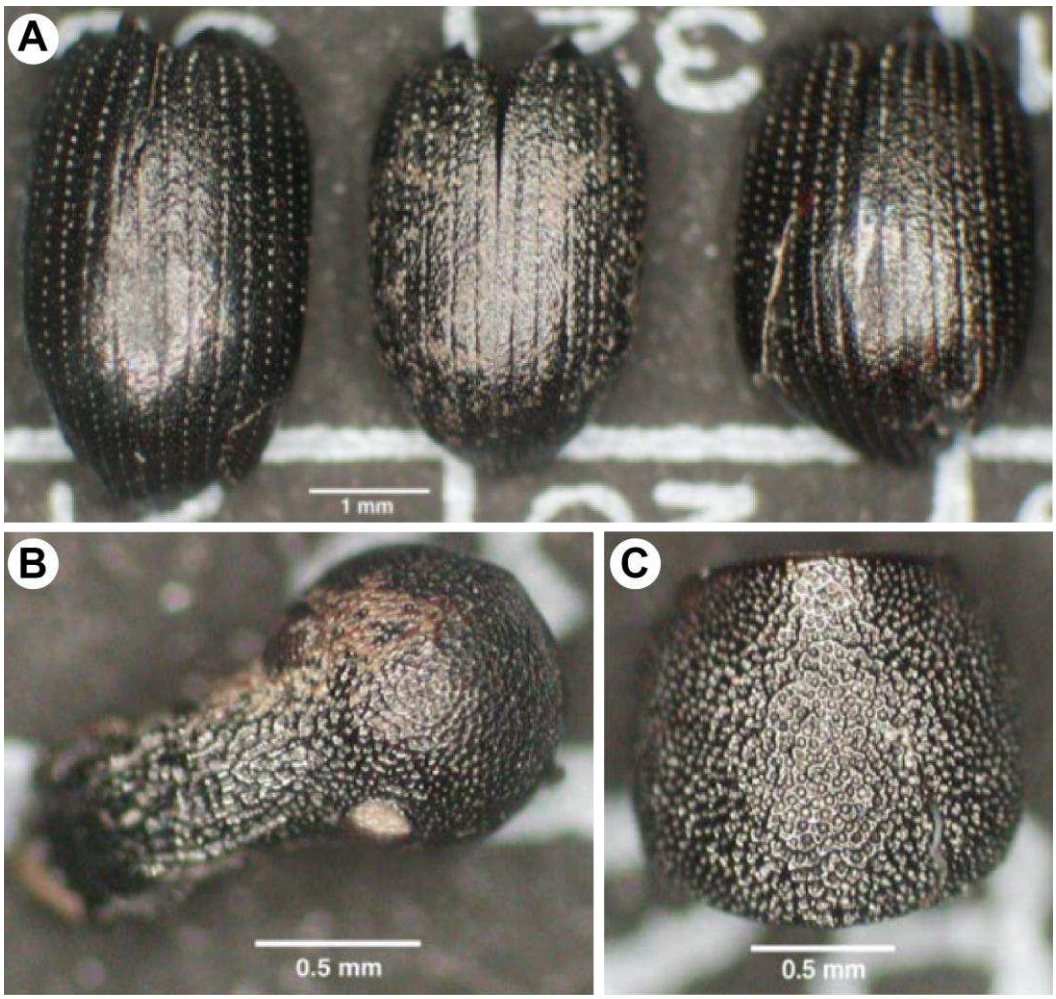

Figure S3 Remains of the weevil Lepidophorus lineaticollis collected from section 05-01, east 'Summer Bay'. (A) Three articulated fossil elytra. (B) Fossil head. Note that some surface scales (brown patches) are still intact on the elytra and head (C) Fossil prothorax. The dated weevil fossils yielded a non-finite age of >52,200 ^{14}C years BP (UCIAMS-34415).

Figure S4 Willow (Salix) twig with bark and persistent bud intact, collected from section 05-01, east 'Summer Bay'. This sample provided a ^{14}C age of >51,700 ^{14}C years BP (UCIAMS-34417). For scale, background grid lines are ~4 by 4 mm.

Figure S5 Wild raspberry (Rubus idaeus) seeds, collected from sample 08-001, east 'Summer Bay'. This sample provided a ^{14}C age of >45,900 ^{14}C years BP (UCIAMS-73117). For scale, background grid lines are ~4 by 4 mm.

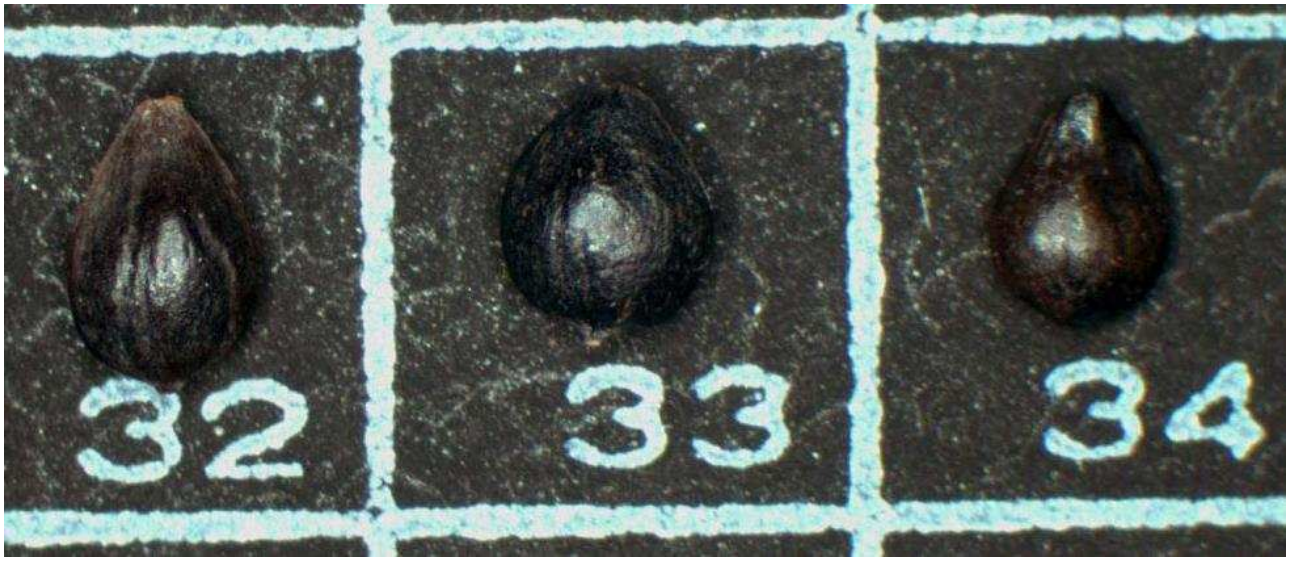

Figure S6 Bulrush (Schoenoplectus tabernaemontani) achenes, collected from sample 08-001, east 'Summer Bay'. This sample provided a ^{14}C age of >54,700 ^{14}C years BP (UCIAMS-73118). For scale, background grid lines are ~4 by 4 mm.

Supporting Tables

Table S1 Lithostratigraphy and sedimentology of section 08-16, south coast of Summer Island

Unit (thickness)	Description	Interpretation
Sand (4.4 m)	5Y 4/2 (olive grey; moist), fine to medium-grained sand, plus 5Y 3/2 (dark olive grey; moist) silty sand; pervasive in situ roots; contains organic layer (0.1–0.3 m thick) of black sandy humic peat, with recumbent fold; discontinuous basal lag of granules to 70 mm cobbles, rounded to subrounded, with occasional block of black peat, above angular unconformity marking lower contact with Kidluit Fm	Bluff-top aeolian sand-dune deposits containing buried front of solifluction lobe. Basal erosion surface overlain by gravel lag (deflation and / or overland flow)
Kidluit Fm (4.8 m)	5Y 5/1 (grey; moist) fine to medium-grained sand; well stratified, planar parallel laminae 1 to several mm thick, subhorizontal; numerous granules to 20 mm pebbles, rounded; occasional reddish wood fragment; cut-and-fill structures few tens of mm deep, 100–150 mm wide, containing granules, pebbles and intraclasts ≤ 50 mm of Hooper clay; black comminuted organic fragments, including plant stems, more common above lower 2 m of unit; intraclasts of Hooper clay most common in lower 1.5 m of unit	Fluvial sand deposited by braided river system
Hooper clay (≥ 6 m)	Gley 1 3/N (very dark grey; moist) to 5Y 3/1 (very dark grey; moist) clayey silt; generally massive, locally crudely stratified, with strata few tens to several tens of mm thick, parallel; occasional wood fragment (≤ 230 mm long); cohesive; upper 10–30 mm brecciated and weathered slightly yellow brown	Marine clay

Table S2 Lithostratigraphy and sedimentology of section 05-01[a], east coast of 'Summer Bay'

Unit (thickness)	Description	Interpretation
Sand (1–2 m)	Fine to medium-grained sand; pervasive in situ roots	Aeolian sand sheet
Peat (0.3–0.5 m)	Black, sandy peat	Peat accumulation
Pebbly sand (≤ 0.15 m)	Pebbles to 150 mm cobbles	Flood deposit
Kittigazuit Fm (c. 9)	5Y 3/2 (dark olive grey) silty fine sand and 5Y 4/2 (olive grey) fine sand form alternating strata few mm to 40 mm thick, undulating, parallel to subparallel; occasional reddish wood fragment; scattered pebbles ≤ 20 mm, rounded, above sharp lower contact	Aeolian sand rests on basal erosion surface Thermal contraction cracking along palaeo-land surface developed on top of Kidluit Fm
Kidluit Fm (c. 6)	Tabular cross sets ~0.5–2 m thick, separated by planar to curved erosional bounding surfaces. Three facies: (1) 2.5Y 3/2 (very dark greyish brown) and 2.5Y 5/2 (greyish brown) well-laminated sand, planar parallel lamination 2–10 mm thick of alternating thicker light-coloured and thinner dark-coloured laminae, dipping at 16° towards 306° (2) 2.5Y 3/1 (very dark grey) fine sand and black organic debris; well laminated, planar parallel laminae 2 to several mm thick; climbing ripples marked by finely comminuted organic debris on foresets; concave-up lower contact truncates underlying laminae (3) Woody sand, comprising alternating strata of 2.5Y 3/2 (very dark greyish brown) fine sand 2–10 mm thick vs black woody debris few mm to 40 mm thick; planar parallel stratified; wood fragments ≤ 70 mm diameter, ≤ 0.7 m long, rounded, aligned parallel to stratification; sharp lower contact truncates strata in underlying facies Intraclasts of organic-rich silt, Gley 1 2.5N (black, moist) in basal 100 mm of unit, angular to subangular, ≤ 130 mm max. dimension, some laminated and containing delicate leaves; sharp, gently undulating lower contact about 2 m above high water mark Sand veins and sand wedges extend down from upper contact	Fluvial sand deposited by braided river system Abrasion and rounding of wood fragments during transport Rip-up clasts eroded from pre-existing organic-rich silt and incorporated into basal 100 mm
Hooper clay (≥ 2 m)	10YR 3/1 (very dark grey) clayey silt crops out on beach; massive; numerous white shell fragments, dispersed; brecciated in the form of platy fragments few mm to 20 mm thick, horizontal to subhorizontal, aligned parallel to contact with overlying Kidluit Fm	Marine clay Brecciation due to ice segregation

[a] This section is thought to be in the vicinity of section 46W reported in Rampton (1988, fig. 35).

Table S3 Lithostratigraphy and sedimentology of section 08-04, south coast of 'Summer Bay'

Unit (thickness)	**Description**	**Interpretation**
Sand (1 m)	Fine to medium-grained sand; pervasive in situ roots; overlies pebbly organic layer	Peat accumulated on pebbly lag before buried by aeolian sand sheet
Pebbly sand (≤ 0.6 m)	Massive pebbly sand with abundant pebbles to 135 mm cobbles, rounded to subrounded; matrix- to clast-supported; overlies sharp, concave-up contact that truncates vertical lamination in underlying sand wedge	Fluvial channel infill
Sand wedges	Medium to coarse-grained sand; granules to small pebbles in upper 0.5 m, elongate pebbles 20 mm long vertically oriented; top of sand wedge 2 truncated by channel infilled with pebbly sand (see Figure S2)	Thermal contraction cracking and infilling of cracks with blown sand
Kidluit Fm (c. 3.5)	Four facies: (A) Pebbly sand: 2.5Y 6/1 (grey, moist), massive, medium to coarse sand; abundant granules to cobbles (≤ 100 mm in maximum dimension), rounded to subrounded; cut-and-fill structure; overlies concave-up sharp base (B) Fine- to medium sand: 2.5Y 6/1 to 7/1 (grey to light grey, moist) planar parallel laminae few to several mm thick; coal fragments and wood fragments concentrated along some laminae (C) Woody sand: 2.5Y 5/4 (light olive brown, moist) fine to medium sand; well stratified, strata few mm to 30 mm thick, parallel, gently undulating to slightly wavy; abundant dark red wood fragments ≤ 220 mm long, typically aligned parallel to each other; abundant coal fragments, ≤ 90 mm long, typically with rounded edges (D) Gravel, pebbly sand or coarse sand: wood fragments ≤ 330 mm long; cobbles ≤ 100 mm; concave-up base	Fluvial sand deposited by braided river system Infilled channels
Hooper clay	Dark grey, icy clay	Marine clay

Table S4 Plant macrofossils from sample kd1

Fungal remains		
fungal sclerotia		+
Algal remains		
Characeae		
	Chara sp.	+
Non-vascular plants		
Bryophytes...."mosses"		+
Vascular plants		
Selaginellaceae...."spikemoss family"		
	Selaginella selaginoides (L.)Link	+
Equisetaceae ....."horsetail family"		
	Equisetum sp.	+
Pinaceae ....."pine family"		
	Picea sp.	++
Sparganiaceae ....."bur-reed family"		
	Sparganium sp.	+
Potamogetonaceae .."pondweed family"		
	Potamogeton spp.	+
Hydrocharitaceae...."tape-grass family"		
	Najas flexilis (Willd.) Rostk. & W.L.E.Scmidt	+
Poaceae....."grass family"		+
Cyperaceae ....."sedge family"		
	Carex lenticular type (spp.)	+
	Carex trigonous type	+
	Eleocharis palustris (L.) Roem. & Schult.	+
	Schoenoplectus tabernaemontani (C.C. Gmel.) Palla	+
Salicaceae ....."willow family"		
	Salix sp.	+
Betulaceae ....."birch family"		
	Betula nana/glandulosa type	+
	Alnus alnobetula (Ehrh.) K.Koch	+
Chenopodiaceae ...."goosefoot family"		
	Chenopodium sp.	+
Ranunculaceae ....."crowfoot family"		
	Ranunculus macounii/pensylvanicus type	+
	Ranunculus aquatilis L.	+
Papaveraceae ....."poppy family"		
	Papaver sp.	+
Brassicaceae ....."mustard family"		
	Draba sp.	+
Rosaceae ....."rose family"		
	Potentilla sp.	+
	Rubus idaeus L.	+
Haloragaceae ....."water milfoil family"		
	Hippuris vulgaris L.	+
Ericaceae ....."heath family"		+
	Empetrum nigrum L.	+
	Arctous alpina/rubra type	+
Gentianaceae ....."gentian family"		
	Menyanthes trifoliata L.	+
Other:		
	Tertiary amber	+
	Tertiary coal	++
	Tertiary megaspores	+
	wood/twigs	++
	charcoal	+

+ = taxon present; ++ = taxon abundant

Table S5 Insect fossils from sample kd1

FORAMINIFERA ....."forams"	+
PORIFERA ....."sponges"	+
Haplosclerina	
Spongillidae	
Spongilla sp.	+
BRYOZOA	
Cristatella mucedo L.	+
ARTHROPODA	
INSECTA	
COLEOPTERA....."beetles"	
Carabidae ....."ground beetles"	
Diacheila polita Fald.	1
Elaphrus sp.	1
Pterostichus (Cryobius) tareumiut Ball	1
Pterostichus (Cryobius) parasimilis Ball	1
Pterostichus (Cryobius) pinguedineus Eschz.	2
Pterostichus (Cryobius) ventricosus Eschz.	3
Pterostichus (Cryobius) brevicornis Kby.	1
Pterostichus (Cryobius) sp.	+
Pterostichus (Lenapterus) agonus Horn	1
Amara alpina Payk.	2
Dytiscidae ....."predaceous diving beetles"	
Hydroporus sp.	1
Agabus moestus (Curtis)	1
Hydrophilidae ....."water scavenger beetles"	
Cercyon herceus Smetana	1
Staphylinidae ....."rove beetles"	
Tachinus sp.	1
Byrrhidae ....."pill beetles"	
Simplocaria metallica (Sturm)	1
Morychus aff. aeneolus (LeC.)	2
Brentidae ....."straight-snouted weevils"	
Mesotrichapion cyanitinctum (Fall)	3
Curculionidae ....."weevils"	
Lepidophorus lineaticollis Kirby	22
Lepidophorus thulius Kiss.	1
Isochnus arcticus (Korotyaev)	2
DIPTERA ....."flies"	+
Chironomidae ....."midges"	+
HYMENOPTERA ....."wasps and ants"	
Formicidae ....."ants"	
Camponotus sp.	+
CRUSTACEA	
Cladocera ....."water fleas"	
Daphnia sp.	+
Ostracoda	+
Notostraca ....."tadpole shrimp"	
Lepiduris sp.	+
ARACHNIDA	
Acari ....."mites, ticks"	
Oribatida ....."oribatid mites"	+
MOLLUSCA	
Gastropoda ....."snails, limpets" (freshwater types)	+
Pelecypoda ....."clams, mussels" (freshwater types)	+
Other:	
small mammal fecal pellets	++

+ = taxon present; ++ = taxon abundant

Table S6 ^{14}C ages and sample details

UCIAMS number	Sample name	$\delta^{13}C$ (‰)	±	Modern fraction	±	$D^{14}C$ (‰)	±	^{14}C age (BP)
34415	kd1 beetle	–25.8	0.1	0.0007	0.0004	–999.3	0.4	>52,200
34417	kd1 twig	–31.7	0.1	0.0000	0.0008	–1000	0.8	>51,700
73117	08-001 berry	–27.8	0.1	0.0019	0.0007	–998.1	0.7	>45,900
73118	08-001 bulrush	–26.4	0.1	0.0001	0.0005	–999.9	0.5	>54,700

Radiocarbon concentrations are given as fractions of the Modern standard, $D^{14}C$, and conventional radiocarbon age, following the conventions of Stuiver and Polach (1977). Size-dependent sample preparation backgrounds have been subtracted, based on measurements of ^{14}C-free wood and coal. All results have been corrected for isotopic fractionation according to the conventions of Stuiver and Polach (1977), with $\delta^{13}C$ values measured on prepared graphite using the AMS spectrometer. These can differ from $\delta^{13}C$ of the original material, if fractionation ocurred during sample graphitization or the AMS measurement, and are not shown. $\delta^{13}C$ values shown were measured to a precision of better than 0.1‰ on CO_2 aliquots, using a Finnigan Delta Plus IRMS with Gas Bench input.

Supporting Reference

Stuiver M, Polach HA. 1977. Discussion: Reporting of ^{14}C data. Radiocarbon **19**: 355–363.