A Preliminary Report on a Peat Profile from Skullbone Plains, Central Plateau, Tasmania.

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Skullbone Plain is a complex of mires and grasslands on the western edge of the Central Plateau of Tasmania about 17km NE of Cynthia Bay on Lake St Clair. The Plains occupy an undulating area of ridges and hollows at around 1000-1100m altitude with low ridges supporting *Eucalyptus* woodlands interspersed with *Sphagnum* bog and sedge fens. The area is a former grazing lease on land adjacent to Lake St Clair National Park. It has had a history of timber extraction and has numerous tracks crossing it towards Lake Ina. The property is now owned by the Tasmanian Land Conservancy and managed as part of the National Reserve System. The Tasmanian Land Conservancy is interested in understanding the landscape history and in restoring damaged habitat to former vegetational cover. This report covers the stratigraphy and dating of a deep core taken in a *Sphagnum* bog, together with the pollen analysis of samples that provide an indication of the peat-forming vegetation through time.

The geology is Jurassic dolerite. The area lies just outside the terminal moraine of the last Glaciation but may have been affected by earlier more extensive ice cover.

Study Site.

A large area of mire about 800m southeast of Lake Ina was chosen for coring and a 360cm core (SKB-12) taken on 16/11/12 by Jennie Whinam, Hans Joosten and John Couwenburg (International Mire Conservation Group). The location is GPS: 0441957 5345276 which corresponds to 42° 2.546'S, 146° 17.922'E at 1025m altitude (Tasmanian Land Conservancy 2013). The vegetation at the core site was a *Sphagnum* –shrub bog, with shrubs to 80cm overtopping the moss hummocks. A species list and cover estimate was prepared from a 10x10m plot.

Species	% cover
Sphagnum cristatum	60
Richea scoparia	50
Baloskion australe	10
Baeckea gunniana	30
Sprengelia incarnata	40
Epacris serpyllifolia	5
Celmisia asteliifolia	<1
Oreobolus pumilio	3
Gleichenia alpina	1
Rubus gunnianus	2
Empodisma minus	1
Richea sprengelioides	1
Poa ?labillardierei	<1
Ourisia integrifolia	<1
Moss	10
Lichen	15
Bare ground	3

Methods

After probing, a core was taken with a Russian D Section corer and the stratigraphy described. Samples were cut from the core and bagged.

Four samples were pre-processed for dating. 2.5ml of peat was suspended in distilled water and filtered through an 80 micron nylon filter cloth. The fine fraction was acidified with 10% HCl, washed then treated in hot 8% KOH for 3 hours, washed in water and re-acidified before transfer to small phials. These were sent to Direct AMS (Accium Biosciences) for Accelerator Mass Spectrometric determination of C14 and C13 isotopes.

The same sample depths were prepared by standard techniques for pollen analysis and the carbon content of bulk samples measured on a CNS auto analyser at ANU, Canberra.

Results

Stratigraphy. The bulk of the core was *Sphagnum* peat with dark and light bands representing phases of humification and periods of active growth. The basal 22cm of the core was increasingly clayey.

Depth cm	Sediment
0-4	**Recent material with peat and lichens**
5-15	strongly humified peat with radicels with woody roots; no peat moss
16-24	H3 Sphagnum peat with wood particles & radicels
25-27	darker band of more decomposed material (H6), more strongly humified, many rootlets
28-36	H2-H3 *Sphagnum* peat with Cyperaceae/Restionaceae rootlets
37-40	More strongly humified (H5) – same material as previously with Sphagnum
41-47	Slightly less decomposed, H3, Sphagnum peat with rootlets; tastes acid
48-52	dark band
53-60	lighter band
61-66	darker band, with *Baloskion* seed at 64 cm
67-70	lighter band
71-75	darker band (with *Richea scoparia* root at 73 cm)
76-88	lighter band, radicel, H2
89-99	darker band
100-116	slightly humified, H2
117-120	H4
121-126	H3
127-150	H5, radicels, roots, wood (with *Baloskion* fragment at 129 & *Richea scoparia* woody material at 145 and 173)
151-177	peat moss H4, with *Richea sprengelioides, Richea scoparia*, lots of wood, *Sphagnum-Richea* peat.
178-185	strongly decomposed H5 with rootlets
186-200	many roots, *Richea* wood, fine radicels, H5
201-235	*Epacris* rootlets, *Richea sprengeliodes* at 210; large piece of *Richea scoparia* wood at 232-235; decomposed *R. scoparia* wood at 252, strongly humified
236-266	H5, very wet deposit with fine rootlets
267	*Baloskion* fragments through *Richea scoparia*
271-273	large piece of *Richea scoparia*, H5, wood rootlets
236-297	homogenous peat
298-311	*Sphagnum* peat H3-H4, has oxidised, wood fragment at 310
312-316	H5 radicel peat, with more mineral content
317-328	radicel peat with clay component; roots into clay
329-349	Sandy clay with fragments of peat
350	rock

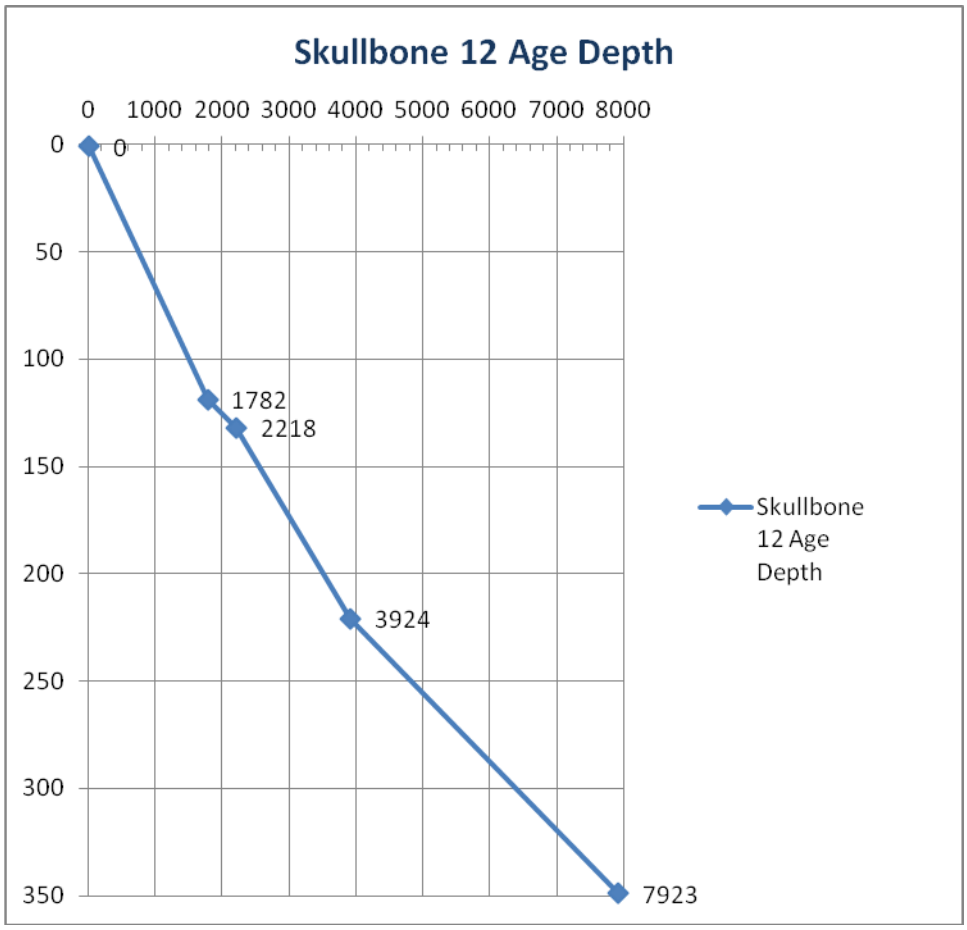
Notes: Radicel peat is primarily composed of sedge rootlets. H values represent the degree of humification with H1 unaltered and H10 all plant structure lost. H3-5 is well preserved fibrous but brown (http://www.science.ulst.ac.uk/vft/vonPost.htm).

The peat was pH 3.45 while water squeezed from *Sphagnum* cushions was pH 3.96. Ionic conductivity was low, at 60µS/cm. The carbon content was very high, at 40-50% dry weight and mineral bands were absent except near the base of the core.

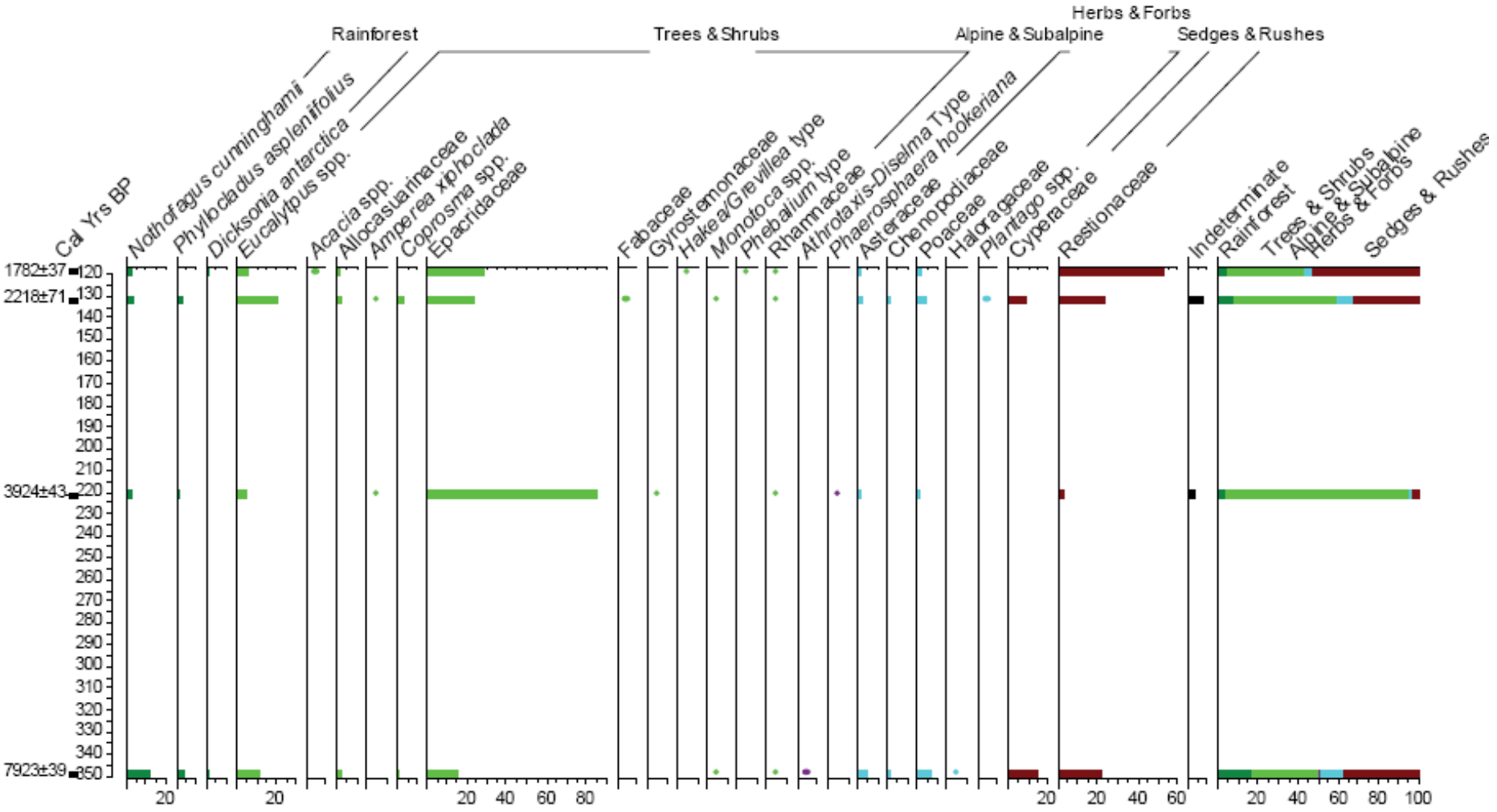
Chronology. Dating results were obtained on peat fines (<80 micron) given Acid-Base-Acid pretreatment:

DirectAMS code	**Submitter ID**	Depth cm	C % dry wt	δC13	±	**C14 age BP**	±	**Calibrated Age BP**	±
D-AMS 001726	SKB12-1	118-120	44.03	-28.9	0.23	1847	23	**1782**	37
D-AMS 001727	SKB12-2	131-133	44.63	-17.9	0.27	2172	28	**2218**	71
D-AMS 001728	SKB12-3	220-222	38.38	19.8	0.27	3609	34	**3924**	43
D-AMS 001729	SKB12-5	348-350	50.32	-11.7	0.19	7098	37	**7923**	39

Assuming that the surface of the bog is modern the calibrated ages provide an age depth curve that suggests fairly even sediment accumulation over the last 8000 years.



The closely dated interval between 132 and 120cm has net peat accumulation rate of 0.30mm/yr which is a slower than the previous and following sections (119cm -surface is 0.66mm/yr and 221cm -132cm is 0.52mm/yr). This suggests that net peat accumulation at this site has been affected by periods of slow growth or increased oxidation and decay. The periods of rapid growth with pale coloured and well preserved fibrous peat are termed Grenz Horizons. In Europe and North American these have been correlated with regional climates becoming wetter and mildly cooler.



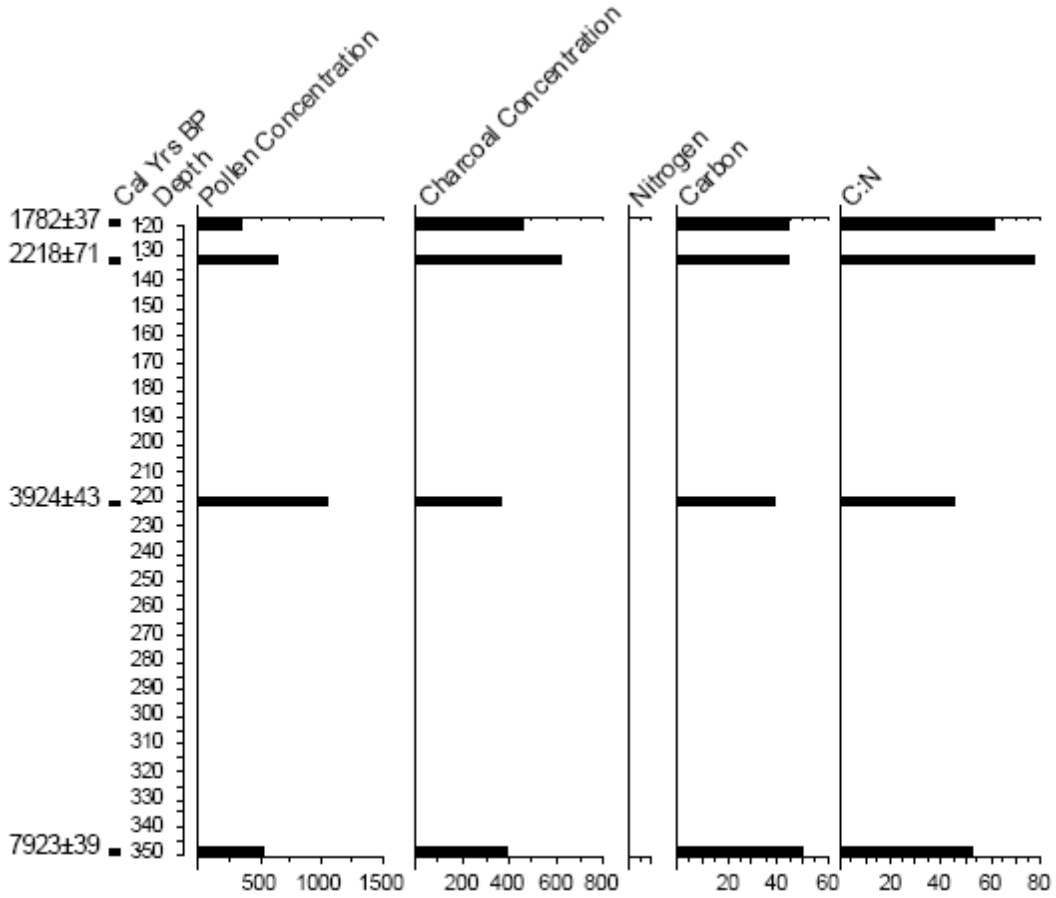
Pollen spectra from the dated levels

Pollen analyses. Pollen was identified in the four levels used for dating. A modern sample was not available to provide a reference to the differences in the site in the past. The sample results are shown in a pollen diagram based on percentages of all pollen and fern spores. *Sphagnum* is usually absent or a minor element as this moss rarely spores. However trace amounts of *Sphagnum* spores were found in the deeper levels but not the 119cm sample. The macrofossils show that the moss was a major element in the upper 2m of the section and it was probably important throughout the history of the deposit.

The major change apparent from the pollen is that, at the base of the site, the mire vegetation was dominated by *Gleichenia* (coral fern), whose spores reach 90%. Restionaceae (twig rushes such as *Baloskion* and *Empodisma*) and sedges were also important and *Sphagnum* was present. By 4000 years ago shrubs had become much more important, particularly epacrids such as *Richea* and *Epacris* species. The upper two samples show a return of twig rushes and a decline in shrubiness. Our initial interpretation is that the bog developed from an original fern and graminoid fen and that its floristic composition has been variable since then, with several possible controls including succession, nutrient availability and disturbances such as fire and changing climates

The dryland vegetation of *Eucalyptus* and rainforest around the site has been relatively stable. There is a suggestion that rainforest has declined since the earliest level but more work would be needed to confirm this. The eucalypt representation remains quite low, so an open woodland can be inferred rather than dense forest having been present.

Charcoal. Burnt plant material occurs at moderate levels in all four samples, indicating that fires were probably occurring on Skullbone Plains throughout its history.



Fire is generally not able to damage peaty sediments while they are moist. Resprouting and continued peat accumulation can occur soon after fires have burnt the surface vegetation.

Discussion

The peat section from Skullbone Plains is a very deep and continuous section which apparently spans most of the Holocene since its inception about 8500 years ago. The section is deep compared to many other mires in the region which are less than 2m and often only 1m deep (Morgan *et al.* 2010). This suggests that conditions, and perhaps nutrition, have been favourable to peat formation on Skullbone Plains. As the bog has developed, the drainage has increasingly been intercepted and stream lines infilled. There would have been a gradual development of the Skullbone mire as peat filled the hollows across the plain.

The site is not particularly old for this region in Tasmania. Deglaciation was probably nearly complete by about 14,000 years BP as shown by several cores from lakes in the area (Hopf et al 2000). At a 2m section from Excalibur Bog, 4.5 km to the south and 785m altitude, clays are accumulating from about 29,000 years ago and the site is occupied by bog by 6,500 yr BP (Hopf, research in progress). In the early Holocene rainforest is well developed there, and replaced by more open vegetation later. Another *Sphagnum* bog on the southwestern corner of Clarence Lagoon (3.9 km south, 970 m altitude) has been cored and produced a section of ~ 1.9m of peat underlain by clay. The base of the peat was dated at 4,900 yr BP and the pollen record for the site indicates a switch from predominantly Restionaceae, *Sphagnum* and Cyperaceae to more shrubby vegetation after 1350 yr BP. It is possible that Skullbone Plain has a more continuous record of the Holocene than other bogs in the region. For example Camerons Lagoon, a fen 35km to the east near Great Lake, has a very discontinuous record of infill (Thomas and Hope 1994), possibly due to deflation after fire or drying episodes.

Further studies. The complete and relatively well preserved section on Skullbone Plains lends itself to a range of scientific studies. A high resolution (every 1-2 cm) analysis of macro-charcoal from the site could provide a basis for estimating the fire return interval for the area through time. More detailed pollen analysis would establish the pattern of development of the mire and could pinpoint the arrival of Europeans and their impact. Macro-botanical analysis in the upper 2.5m could establish the bog changes over the past 4 millennia which might have a correlation with water relations and hence climate change. Such studies could be supported by stable isotope analysis eg δC13. The site is thus an excellent one to act as a baseline in assessing the impact of projected future climate change on peatlands in the region.

Acknowledgement

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