

DINOSAUR DREAMING

FLAT ROCKS, INVERLOCH
FIELD REPORT, 1995



The 1995 Inverloch Field Trip Report

by Lesley Kool

The 1995 Inverloch field trip, at the Flat Rocks site, commenced on January 30th as part of an ongoing 6 year plan to produce a comprehensive work on the Victorian Early Cretaceous fauna and flora by the year 2000. By the end of the 6 week field trip, a crew of some 30 volunteers and staff from the Monash Science Centre and the Museum of Victoria had excavated approximately 12 cubic metres of rock and over 1300 bones and teeth had been catalogued. Preliminary preparation has identified a number of small isolated dinosaur teeth, at least one hypsilophodont dentary and some well-preserved limbs, including a possible small carnivorous dinosaur limb.

The Flat Rocks site, near Inverloch on the south-east coast of Victoria, is situated on the shore platform and is covered by sand for most of the year. Access to the site is possible for approximately 3-4 hours either side of low tide, after which the excavations are inundated by the incoming tide and infilled with sand. Consequently, the overlying sand must be removed every day prior to excavation.

The site was discovered in 1991 as part of a systematic prospecting program along the Strzelecki coastline from San Remo Backbeach to Inverloch. All the rocky outcrops along this stretch of coastline have been dated, using Palynology and Fission Track Dating, at approximately 120 million years old. Dinosaur bones have been known in this area since the turn of the century when a dinosaur claw was found at Eagles Nest, just 1km from the present excavation site. The site is situated within the Bunurong Marine Park and, as such no collection or removal of natural resources is allowed without a permit from the Department of Conservation Forests and Lands. A permit was acquired and regular inspections of the site by the local rangers occurred during the field season.

Various methods of excavation were trialled during previous field trips at this site. These included rock-sawing 40cm square slabs in an effort to remove blocks as cleanly as possible. This method was fairly successful but resulted in sawing through a number of unexposed bones. The best method involved using a series of large chisels at regular intervals along the boundary between the different layers which produced large blocks without causing the rock to fragment too badly.

The first 2 days of the field trip were spent exposing and mapping the entire site, from the low tide mark to the cliff - an area of approximately 40m by 6m. (See Map 1) The object of this exercise was to get a clear picture of the extent of the fossiliferous layer and to decide on an excavation plan for the fieldtrip. It was decided to concentrate on the most easterly end of the outcrop, closest to the water, which is approximately where excavations ended last year.

In other sites in the Strzelecki and Otway Groups, the conglomerate layers containing the fossil bones and teeth, are consistently overlying a thick mudstone layer. At Dinosaur Cove in the Otways, the best fossils were found at or just above the contact between the mudstone and the conglomerate layer. At Flat Rocks site, the mudstone layer is exposed on the southern edge of the lowest conglomerate layer, so it was decided to excavate down to the mudstone/conglomerate boundary and then continue along the boundary, extending north and west.

Palaeo-orientation of some limbs longer than 10cms was recorded (see Map 2), as well as observation of the bones' distribution within the various layers. Most of the bones were found in the conglomerate layers, but a number of isolated teeth and bones were recovered from the interbedded sandstones. A full description of the different layers can be found in the excavation report.

One disturbing incident during the field trip was a case of vandalism which occurred one evening after the crew had left the site. Two large blocks of fossiliferous rocks, which had been excavated just before the incoming tide had inundated the site, had been stored at the top of the beach to be broken down the next morning. On arrival the next day, it was discovered that the rocks had been smashed by persons unknown, and fragments of fossil bones contained within, were scattered over the area. The incident was reported to the Department of Conservation Forests and Lands who have offered to increase security of the site during excavations. It appears that this was an act of vandalism rather than amateur collectors looking for fossils, as a number of bones which were clearly marked on the outside of the rocks, were smashed and left. In future, no excavated rocks will be left behind at the end of each day. This will hopefully discourage any further acts of vandalism or unlawful collection.

EXCAVATION REPORT by Nick Van Klaveren

The Flat Rocks fossil locality was excavated for a period of 6 weeks, from January 30th to March 10th 1995, producing tetrapod bones and bone fragments. This year, the volume of fossiliferous rock was increased by systematically undermining the clay gall conglomerate and driving wedges into underlying sandstone. This method produced larger blocks of fossiliferous rock because the sandstone is more homogeneous and shears coherently along a horizontal plane. The larger blocks reduced the number of small bones encountered, which is the most time-consuming factor during excavation.

Two areas were excavated during this year's dig (See map 1). The area at 97°N, 188°E was targeted for a test excavation because of the discontinuation of the sandstone unit under the main excavation site. It was thought that this may represent the lower edge of a point bar and may contain increased amounts of fossil material. However, it was found to be a low-lying overbank area with a 6-10cm coal seam directly overlying the basal mudstone. A thin (5-10cm) clay gall conglomerate overlaid the coal layer and was in turn overlain by a carbonaceous sandstone. This area was found to be poor in fossil material, producing only one isolated hypsilophodontid tooth and occasional turtle and fish

fragments. Only one day was spent excavating of this part of the fossil unit before it was abandoned to concentrate on the main site.

The main excavation was at 197°E and 98°N over an area 5m by 4m, to a depth of .6m with a volume of around 10 cubic metres.

Palaeo-orientation data was collected for limb bones greater than 10cm in length, producing an average direction of N125° /N285° (n=7) See map 2.

A number of bone concentrations were observed with numerous small limbs located at 98° 2'N, 197°E. and a number of large limbs found at 97° 5'- 99°N, east of 199° 5'E. The large limb association was found throughout the main clay gall conglomerate with a slight increase in numbers at the lower contact.

FOSSIL UNITS - see Map 3

LCG - Lower Clay Gall Conglomerate Unit

A thin layer of channel lag extends discontinuously, overlying the massive basal sandstone unit. It has a thickness of around 5cm and is only carbonaceous at its lower contact. Vertebrate fossils are sparse in this unit and are limited to fish and turtle fragments. In the main excavation area two turtle limbs were found at 97°N, 199° 5'E. This unit contained a single hypsilophodontid tooth at 97°N, 188°E in the test excavation site.

LSS - Lower Sandstone Unit

This massive unit of sparsely carbonaceous sandstone approximately 25cm thick and containing numerous small fish and turtle fragments. Fossils of scientific importance collected from this unit include an isolated large theropod tooth (2.5cm long) and a few well preserved vertebrae.

MCG - Middle Clay Gall Conglomerate Unit

This unit occurs west of 197°E in the main excavation area and, to the east, it merges with the Upper Clay Gall Conglomerate Unit to form one unit. The lower contact is marked by large carbonized logs 5-10cm in width, and to the east of 199° 5'E by large limb bones. A well preserved hypsilophodontid dentary was located in this unit at 98° 32'N, 196° 85'E.

MSS - Middle Sandstone Unit

A thin (5-10cm) layer of sparsely carbonaceous sandstone occurring west of 197°E, containing few vertebrate fossils.

UCG - Upper Clay Gall Conglomerate Unit

This is the main fossil-bearing unit with the majority of bones, especially the larger limbs, being recovered close to the upper contact. The thickness of this unit varies from 5cm at 201°E and to a maximum of 39cm at 197°E.

The merging of the MCG with the UCG may represent a confluence of two channels. However, this does not give the direction of stream flow, as it may have been an anastomosing system.

USS - Upper Carbonaceous Sandstone

A thin unit of approximately 5cm thickness extends from 194°E to an unknown distance east of the main excavation area. This unit is particularly coarse-grained with weathered lithic fragments of feldspar which are completely kaolinized. Pebbles of rounded quartz are common. Bones within this unit are sparse. However, a large limb and two associated bones were found at 98° 32'N, 196° 85'E. A large fragment of turtle plastron and a small unidentified jaw were also recovered in this unit at 98° 3'N, 197°E.

RESULTS

Last year's field trip lasted 4 weeks and resulted in the collection of approximately 600 bones and teeth. This year the field season was extended to 6 weeks and resulted in the collection of over 1300 specimens. The sizable increase in the number of bones collected was probably due to the more efficient method of rock extraction rather than a larger concentration of fossils.

On the last day of the field trip, the whole site was exposed to reveal the extent of the season's excavations (shaded area on Map 1). The exposed area was mapped, indicating the unit boundaries. It was noted that the thickest part of the conglomerate layers occurred where the upper and middle conglomerate layer merged.

Most of the 1300 specimens catalogued consisted of partial bones and turtle shell fragments. However, a number of potentially important bones were also recovered including a well preserved hypsilophodontid dentary (tooth-bearing bone in lower jaw) containing three unerupted teeth. Numerous isolated hypsilophodontid teeth were also collected, confirming these little herbivorous dinosaurs as the dominant dinosaurs in Victorian Early Cretaceous sites.

Other dinosaurs represented at this site include small carnivorous dromaeosaurids, identified by almost 20 isolated teeth and a possible limb. The 1995 season produced both the smallest and largest teeth of this species of meat-eating dinosaur, and it is anticipated that a partial skull or jaw will be found in the near future.

Another dinosaur represented in this fauna, again from isolated teeth, is an unidentified species of ankylosaur. Only 3 teeth have been recovered so far, but it is hoped that comparison with ankylosaurid teeth from both Queensland and overseas will lead to its identification.

Isolated teeth are also the only evidence so far of a species of fresh-water plesiosaur.

A number of well preserved limbs were also collected, some of which have been identified as hypsilophodont femora. Others will require further preparation before their identity is possible. At this stage, it is too early to predict if all the hypsilophodontid femora collected this season are from one hypsilophodontid femoral type. But, preparation will continue for the rest of the year in an effort to identify as many specimens as possible. No articulated specimens were recovered, however there were a number of associated bones collected.

Turtles are well represented in the collection by isolated limbs and shell fragments. Fish are also abundant, represented by skull and jaw fragments as well as isolated scales.

Three cores were drilled in September 1994, to a depth of approximately 1.5m. They are marked on Map 2. The drill cores indicated that the fossil conglomerate/mudstone boundary occurred at a depth of 1.4m to the north of the present site. This season's excavations overtook DDH1 and finished close to DDH2. Therefore more drill cores, approximately 10m further north along the shore platform, will provide valuable information regarding the relative thickness and depth of the conglomerate layers. This information will assist in deciding whether to continue excavations to the north of the present site or, to concentrate on removing existing surface conglomerate to the west of this year's excavations.

The Future

This year's excavations confirmed the richness of the Flat Rocks site. Approximately 12 cubic metres of rock were removed from the shore platform and broken down. Although the various layers revealed different concentrations of fossiliferous material, it was obvious that the site as a whole was by no means exhausted. If anything, the concentration of bones appeared to be increasing, especially where the two upper conglomerate units were merging. Future excavations will concentrate on the area where the conglomerate layers are thickest.

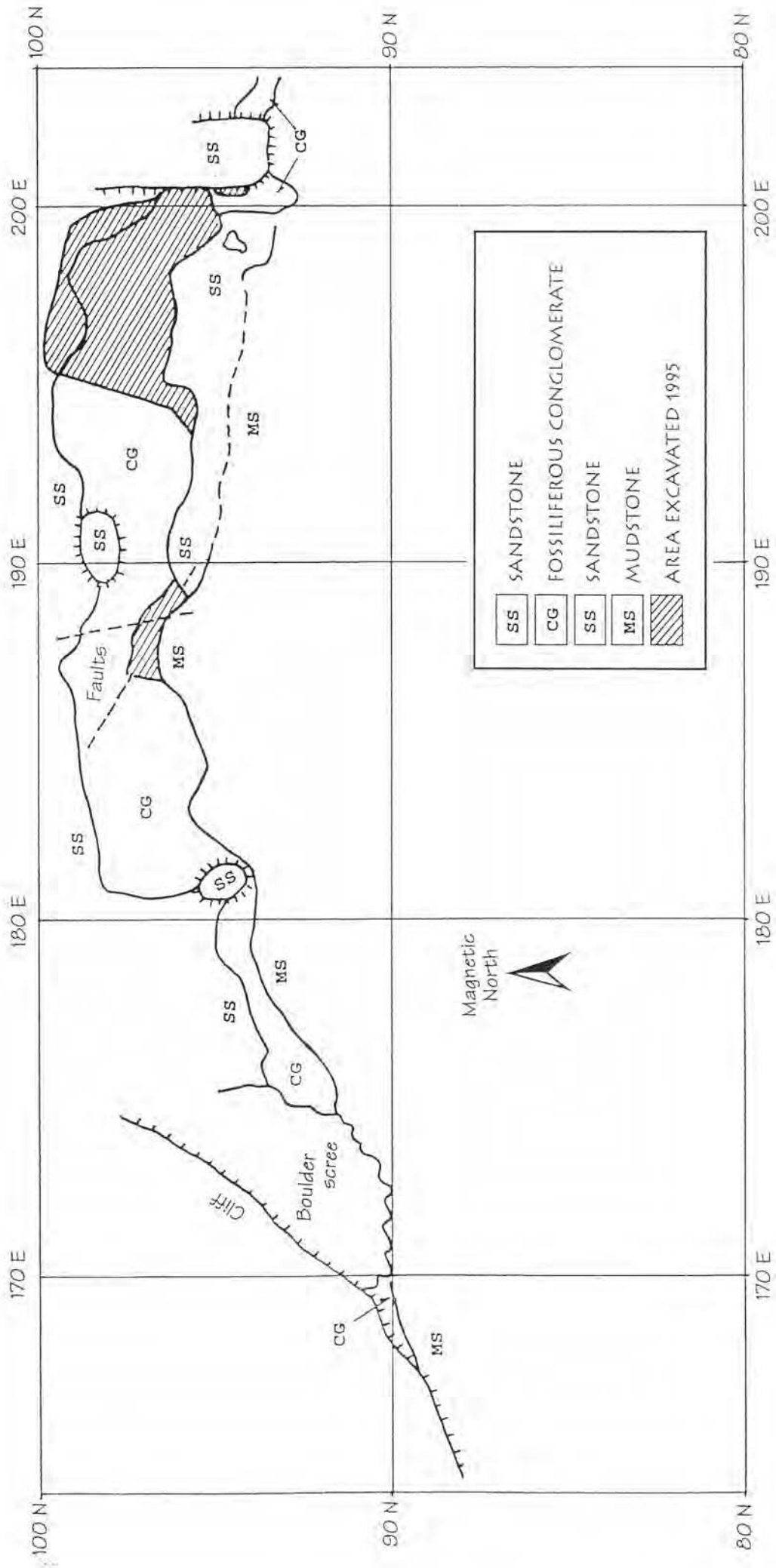
Personnel

The following persons assisted with the work at Flat Rocks site in 1995. Most of them are volunteers, and without their hard work and enthusiasm, none of this year's excellent results would have been possible.

Marion Anderson
Kerrie Auselbrook
Allan Berman
Mike Cleeland
Andre Coffa
Coral Delarue
Caroline Ennis
Alan Evered
Nicole Evered
Darren Grocke
Cindy Hann
Ivan Kobiolke

Amanda Kool
Lesley Kool
Gary McWilliams
Beverley Lamrock
Helen Mitchell
Jenny Monaghan
Dave Pickering
Tom Rich
Natalie Schroeder
Doris Seegets
Cain Sidon
Martin Taylor

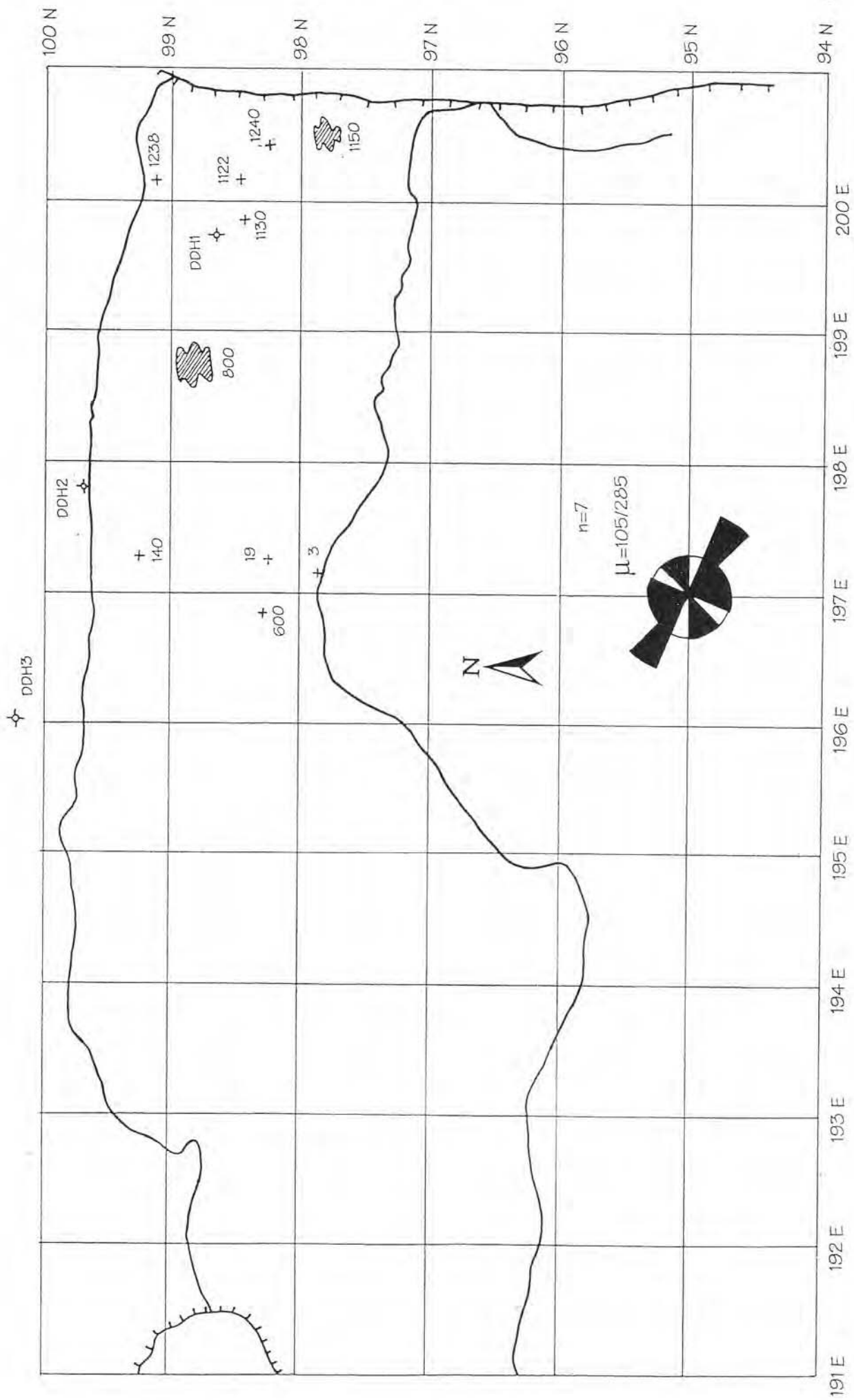
Dianne Tweedale
Sanya Van Huet
Nick Van Klaveren
Patricia Vickers-Rich
Mary Walters
Corrie Williams
Mary Walters
Aaron Zurbo
John Zurbo



Flat Rocks fossil locality
Geological plan

Scale 1:160

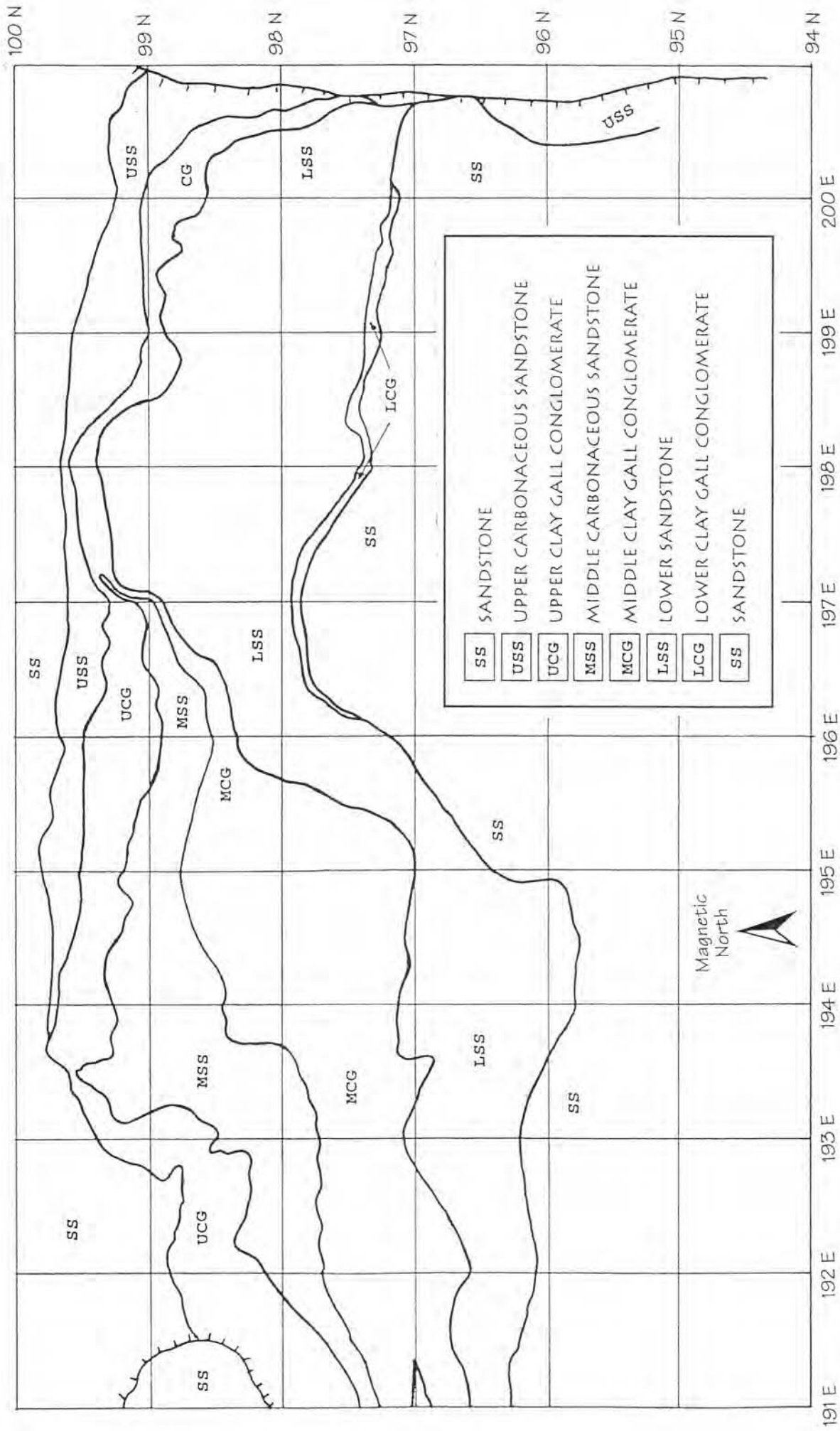
Mapped 30 & 31 January 1995
Drawn 15 March 1995



Large limb bone positions and orientations

Drawn 15 March 1995

Map 2



Flat Rocks fossil locality
Geological plan

Scale 1:40

Mapped 10 March 1995
Drawn 15 March 1995

Map 3