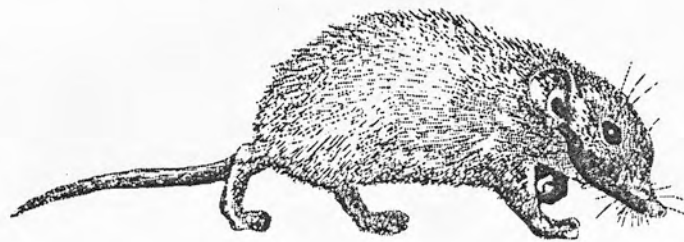


DINOSAUR DREAMING

1997



Reconstruction of Early Cretaceous mammal featuring jaw.
(Actual size)

Flat Rocks Site Report

DINOSAUR DREAMING 1997 FIELD REPORT

by Lesley Kool - Dinosaur Dreaming Co-ordinator

Dinosaur Dreaming 1997 was the fourth and most successful field trip to the Flat Rocks site, Inverloch, Victoria. Over 1300 bones and teeth were catalogued including the first Early Cretaceous mammal jaw found in Victoria. The six week field trip involved almost 40 volunteers, some coming from as far away as Germany and the United States to join the excavations.

The Flat Rocks site was discovered in 1991 as part of a prospecting program whereby the Strzelecki coastal shore-platform, from San Remo to Inverloch, was systematically searched at low tide, for exposed bones. Large areas of the shore-platform are often covered by sand, but as luck would have it, on the day the area west of Inverloch was prospected, the sand had been swept from the rocks by strong winds and high water. Consequently, more than 20 small bones were discovered in an exposed fossil layer approximately 4 metres wide, stretching up the beach and into the cliff. This represented the largest concentration of fossil bones found anywhere along the Victorian coastline, and after a preliminary excavation the following year, extensive excavations began in 1994.

There were three objectives for the 1997 excavations:

1. Continue excavating the main area (Map 2, area 1) down to the lower sandstone layer.
2. Continue sampling the overlying sandstone (Map 2, area 3) to determine whether the 15 fossil bones, including an ornithomimid dinosaur claw, recovered the previous year represented an isolated pocket of bones or a larger deposit.
3. Sample the underlying sandstone (Map 2, area 4) on the south side of the site to determine if there was any evidence of fossil bones, articulated or otherwise.

The second and third objectives were completed satisfactorily. The first objective remains an ongoing project as it became obvious that more of the overlying sandstone needed to be removed to gain access to the deepest part of the site. This will be a major priority next field season as it is from this area that the mammal jaw was discovered.

After extensive research, Dr. Tom Rich has come to the conclusion that the mammal jaw is a well-preserved dentary of a tribosphenic mammal which shows characteristics of primitive placental mammals. This is undoubtedly the most exciting discovery from the Early Cretaceous of Victoria. This possible placental mammal is of similar age to *Prokennalestes* from the Early Cretaceous of Mongolia and the first of its kind of this age from Gondwana. Dr Rich, a palaeomammalogist, has been searching for these

elusive mammals in Australia for nearly 26 years, and so was obviously delighted with the find.

Additional preparation of some of the remaining 1300 bones recovered this field season has revealed the possibility of the first embryonic hypsilophodontid femur from the Early Cretaceous of Victoria. This tiny femur is only 29mm long, and it has been estimated that the original dinosaur would have only been approximately 23cm in length. Tiny limbs have been found from previous digs, but this is the first bone to be positively identified as a hypsilophodontid femur.

One specimen caused some excitement when it was found because its cross section looked skull-like. After preparation it was obvious that it was not a skull but a centrum (part of a vertebra). However, it was unlike any other centrum previously prepared from this site. Its internal structure contained large air pockets which had been infilled with mudstone and fine-grained sandstone. It also possessed large pleurocoels on either side of the centrum, which are characteristic of saurischian dinosaurs. The centrum measured approximately 3 cm long and probably belonged to a juvenile animal, as the sutures between the centrum and the missing dorsal processes were not ossified. Its size and internal structure suggests it is probably from a medium-sized theropod dinosaur, yet unnamed.

Another specimen, a badly damaged tibia approximately 20cm long, appears to have 4 or possibly 5 puncture marks along one side of the shaft, suggestive of tooth marks of some predator or scavenger. Further investigation of these marks is necessary to confirm their identity.

A number of thin walled, hollow limbs have been found, but most of them have no ends preserved by which they can be identified. However, this year a hollow limb, infilled with sediment and with one end preserved has been prepared. Preliminary research suggests that it may be the distal end of a pterosaur metacarpal or metatarsal. Although the limb is only approximately 2 cm long, a foramen close to the distal end has been preserved which appears to be characteristic of pterosaur limbs. This foramen is not present in dinosaur, turtle or other reptilian limbs. However, further research is necessary to confirm this initial identification.

EXCAVATION REPORT by Nick Van Klaveren (Site Excavation Manager)

The Flat Rocks fossil locality was excavated for a period of six weeks, from the beginning of February to mid-March 1997. The method of excavation continued to be the use of large wedges driven into the rock with a sledge hammer. Two other methods were trialed. The first was a trial excavation during a one day dig late last year, using a Cobra petrol-driven rock drill to plug and feather a series of horizontal holes into the Lower Sandstone unit at area 3 (see Map 2). This method failed due to the poor ground conditions, resulting in the shattering of the rock around the plug and feathers.

The second method involved using the Cobra rock drill in jack hammer mode at area 4 (see Map 2) for one day only during the main field season. Jack hammering ceased immediately when the first bone was found at area 4.

EXCAVATION AREAS:

Area 1:

Area 1 was worked systematically throughout the field season to remove all rocks above the Lower Sandstone unit. Work began at 191 metres east and continued westward to the fault zone at 188 metres east. Rock removed was all that above the Lower Sandstone unit and the top half of the latter. Unfortunately, no further bones were encountered in the Upper Sandstone unit, suggesting that the bones recovered at the end of the 1996 field season, at location 189 metres east and 99 metres north, were in an isolated pocket.

The western limit of area 1 produced a remarkable number of vertebrae and only a few large limbs. The central and eastern areas were worked predominantly along the northern edge, exposed by last season's removal of overburden. A number of large limbs were found around 194 metres east and later at 198 metres east. All of which were confined to the Middle Sandstone unit. Two bones of note were a possible saurischian vertebral centrum at 190 metres east, 99 metres north and the mammal jaw (see Map 4).

Area 2:

A thin remnant of weathered fossil layer had remained untouched on the shore platform since the discovery of the site. It was removed this season in the last week of the dig and although only around 15 centimetres thick, it produced a number of interesting specimens. Most common were large fragments of turtle shell, and a lesser number of limbs. The actual bone producing layer at area 2 was not accurately determined due to the amount of weathering and the thinness of the two uppermost layers (Upper sandstone/Upper conglomerate and Middle sandstone/Middle conglomerate. see Map 1) which were still present although each only a few centimetres thick. Conversely the Lower Clay Gall Conglomerate unit was up to 10 centimetres thick here, in contrast to Area 1, where it is only a few centimetres thick. Of note was the discovery of a conglomerate unit, probably corresponding to the Floor Clay Gall Conglomerate and Floor Sandstone unit at Area 4. This rock type was discovered at 92 metres north and 203 metres east (see Map 1) and is separated from the Lower Clay Gall Conglomerate unit by approximately 8 centimetres of mudstone, which forms a continuous layer above it. A single limb was recovered from the small patch encountered, showing this new area to have potential. The extent of this new unit is unknown as it does not crop out at the southern edge of Area 2. The unit contains quite large clay clasts, indicating a higher energy deposition, suggesting larger bones may be found compared to the other fossiliferous units. Area 2 was found to be terminated on its eastern boundary by an incised sandstone lens.

Area 3:

This area was not worked during the main field season, but was sporadically worked during a number of one day digs last year, and has so far only produced isolated fish and turtle bones. The area worked is of limited extent, and may yet produce more substantial fossils as more of the middle units are exposed, as it appears the upper units are becoming thinner in the western parts of Area 1. A north-south

trending fault zone at 187 metres east may be the boundary between the more fossiliferous eastern area and the fossil-poor western area. The substantial increase in coal at the base of the Lower Clay Gall Conglomerate unit in the western zone could represent an area of overbank deposits and not a main channel as suggested in the eastern area. The Upper and Middle Clay Gall units also rapidly thin out westwards, coinciding with fewer bones, reflecting lower stream energy.

FUTURE PLANS:

Preparations for Dinosaur Dreaming 1998 are already well under way. As in previous years, the 1998 field season will commence at the beginning of February and run for a duration of 6 weeks.

Nick van Klaveren is working on a system to cut down the time required each day to remove the sand and water from the excavation site. Being an inter-tidal site, the excavation pit is filled in with sand and water at every high tide. The time taken to remove the water, using a small pump, and digging out the sand can take up to 2 hours each day, and as we only have an access window to the site of between 6-8 hours between tides, this is a large part of our excavation time. Plans to fill the excavation site with sacks containing empty PEP bottles, secured by mesh in an effort to reduce the amount of sand filling the pit, are being considered. It has been estimated that at least another 4 field seasons are required to remove the remaining fossil layer. During this period, the excavation pit will be expanded considerably so a method to reduce the amount of sand and water from entering the pit each high tide is essential.

A more intensive training program for new volunteers is also being formulated to increase the chances of recognising the tiny bones, which may lead to more evidence of the elusive mammals and other yet undiscovered animals that lived at this still largely unknown time in Australia's past.

Preparation of these small, fragile bones is time consuming and painstaking. The sandstone matrix, which encases the fossils, can only be removed mechanically, either with pneumatic or electric hand tools, or in some cases, with a mounted needle and a microscope. The backlog of unprepared specimens increases each field season with thousands of potentially 'new' discoveries still waiting to be prepared. It could be many years before the real picture of life in the Early Cretaceous of Victoria is finally revealed.

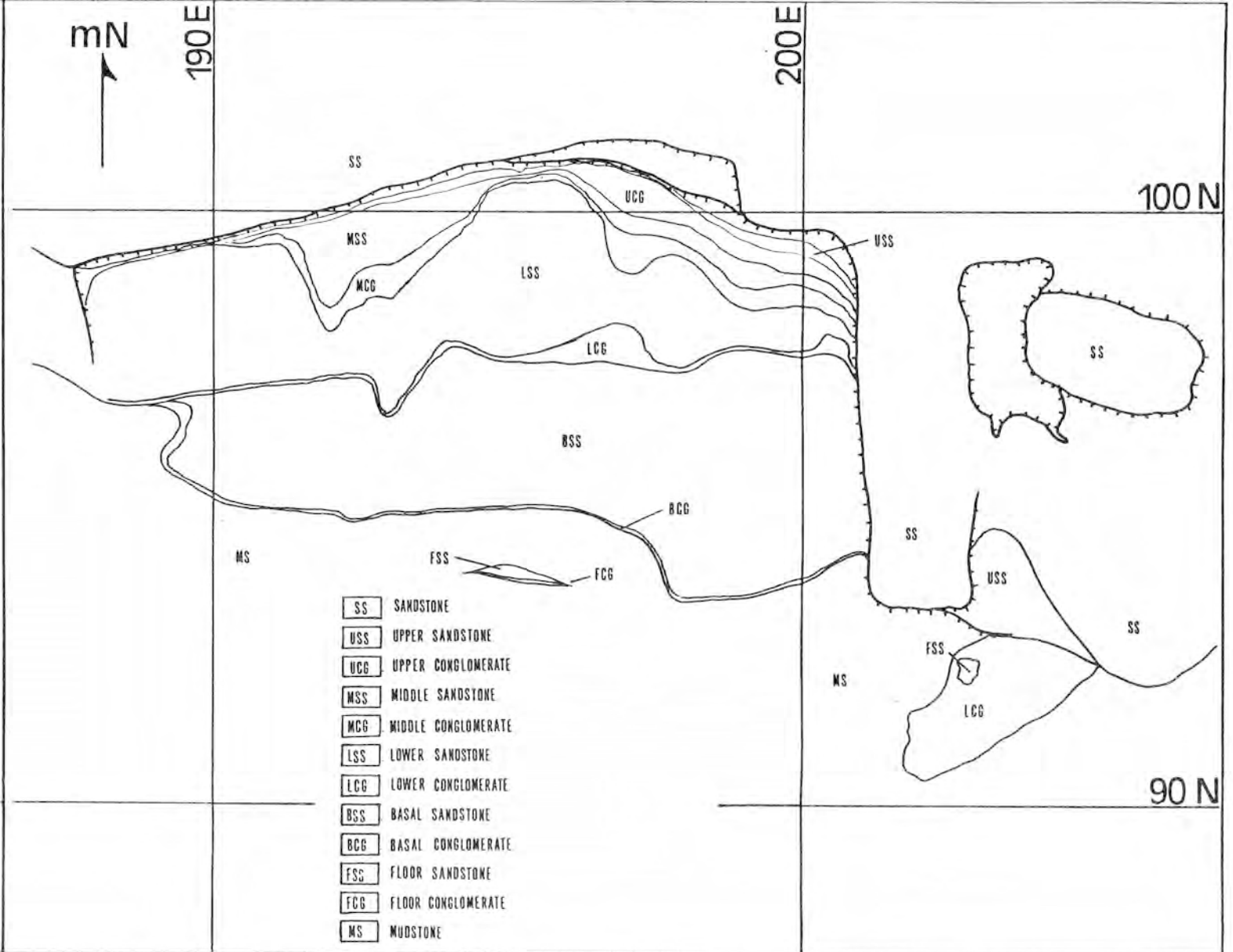
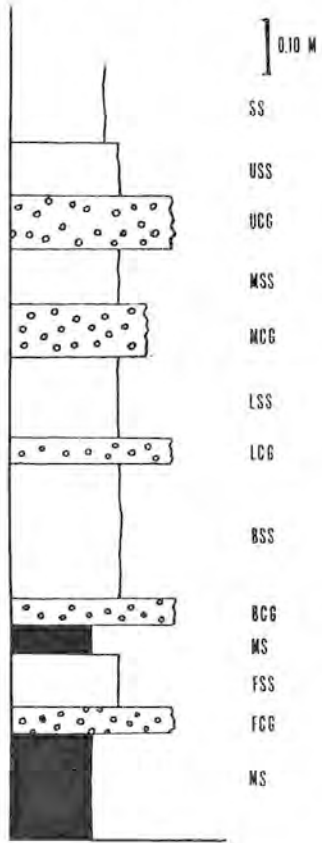
The results of this field season's work are only as good as the people who volunteered their time and enthusiasm to make them possible. We all know that it takes team effort to achieve results and 1997 was no exception. The addition of our 'international' friends enriched our team spirit. To travel thousands of kilometres to help break rock into little pieces shows great enthusiasm, and we are very appreciative. Special thanks must go to Nicola Barton, the 'discoverer' of the mammal jaw. This was her second field season with us and we fervently hope she will return again in 1998 to find more wonderful surprises.

Finally, this report would not be complete without our grateful thanks to The National Geographic Society, whose unflagging support over the years has made our work and discoveries in the Early Cretaceous of Victoria possible.

Dinosaur Dreaming 1997 Crew Members

Don Allison
Marion Anderson
Philip Anderson
Kate Archdall
Allan Berman
Nicola Barton
Mike Cleeland
Andre Coffa
Yeshi Engelbogen
Caroline Ennis
Alan Evered
Nicole Evered
Priscilla Gaff
Norman Gardiner
Draga Gelt
Dean Gilbert
Scott Handsacker
Cindy Hann
Greg Hann

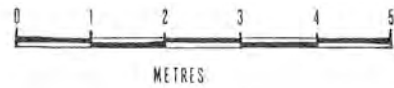
Dorothee Hippler
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Lesley Kool
Mark Lockhart
Geoff MEEK
Andrew Ruffin
Remmert Schouten
Leah Schwartz
Cain Sidon
Daniel Timblin
Dianne Tweedale
Paul van den Bergen
Nick van Klaveren
Doris Villiers
Mary Walters
Manuel Welt



- SS SANDSTONE
- USS UPPER SANDSTONE
- UCG UPPER CONGLOMERATE
- MSS MIDDLE SANDSTONE
- MCG MIDDLE CONGLOMERATE
- LSS LOWER SANDSTONE
- LCG LOWER CONGLOMERATE
- BSS BASAL SANDSTONE
- BCG BASAL CONGLOMERATE
- FSS FLOOR SANDSTONE
- FCG FLOOR CONGLOMERATE
- MS MUDSTONE

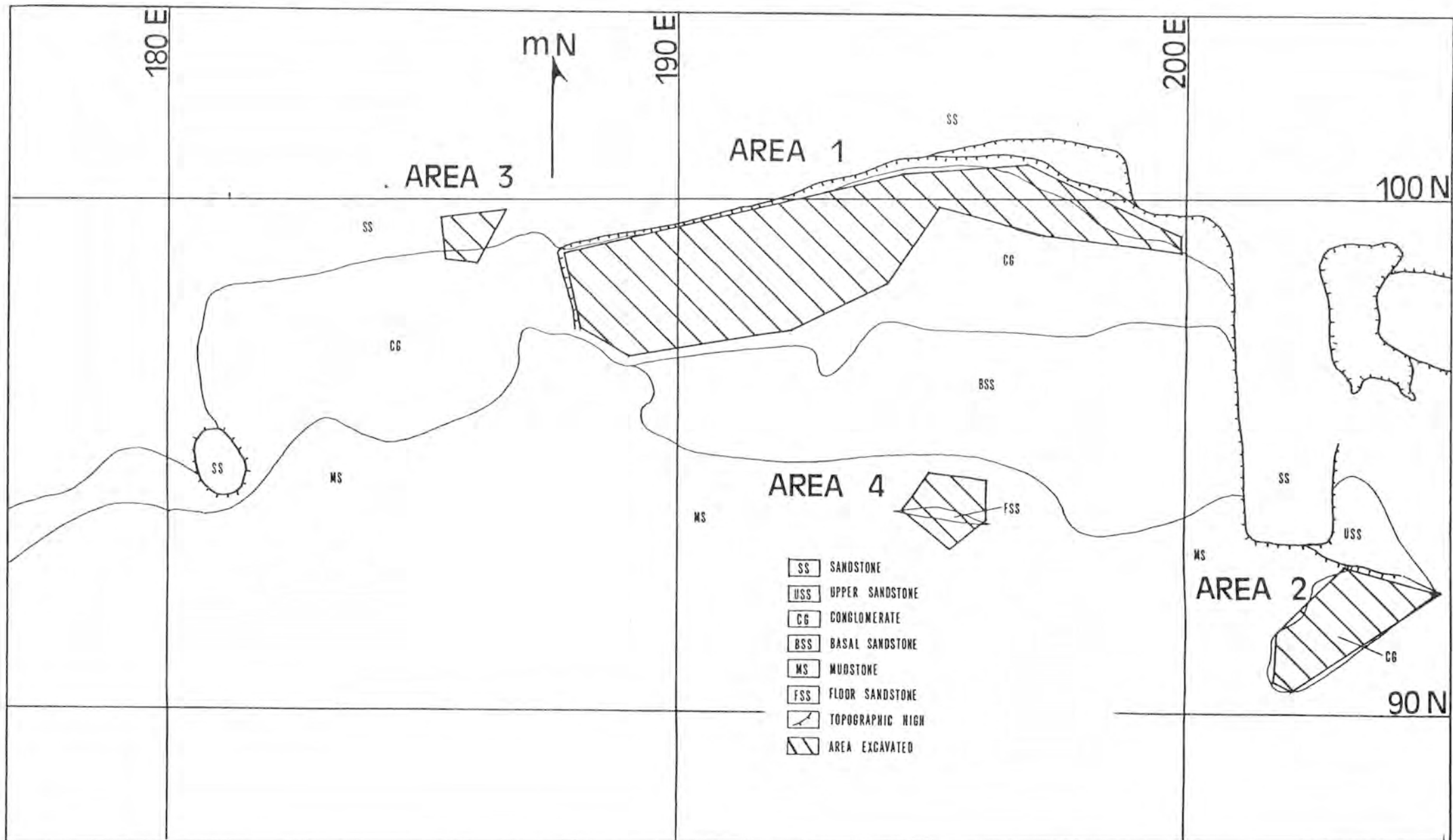
MAP - NICK VAN KLAVEREN

DRAWN 14/3/97



Flat Rocks Fossil Locality, Inverloch
GEOLOGY

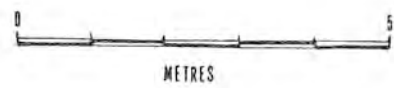
Map 1



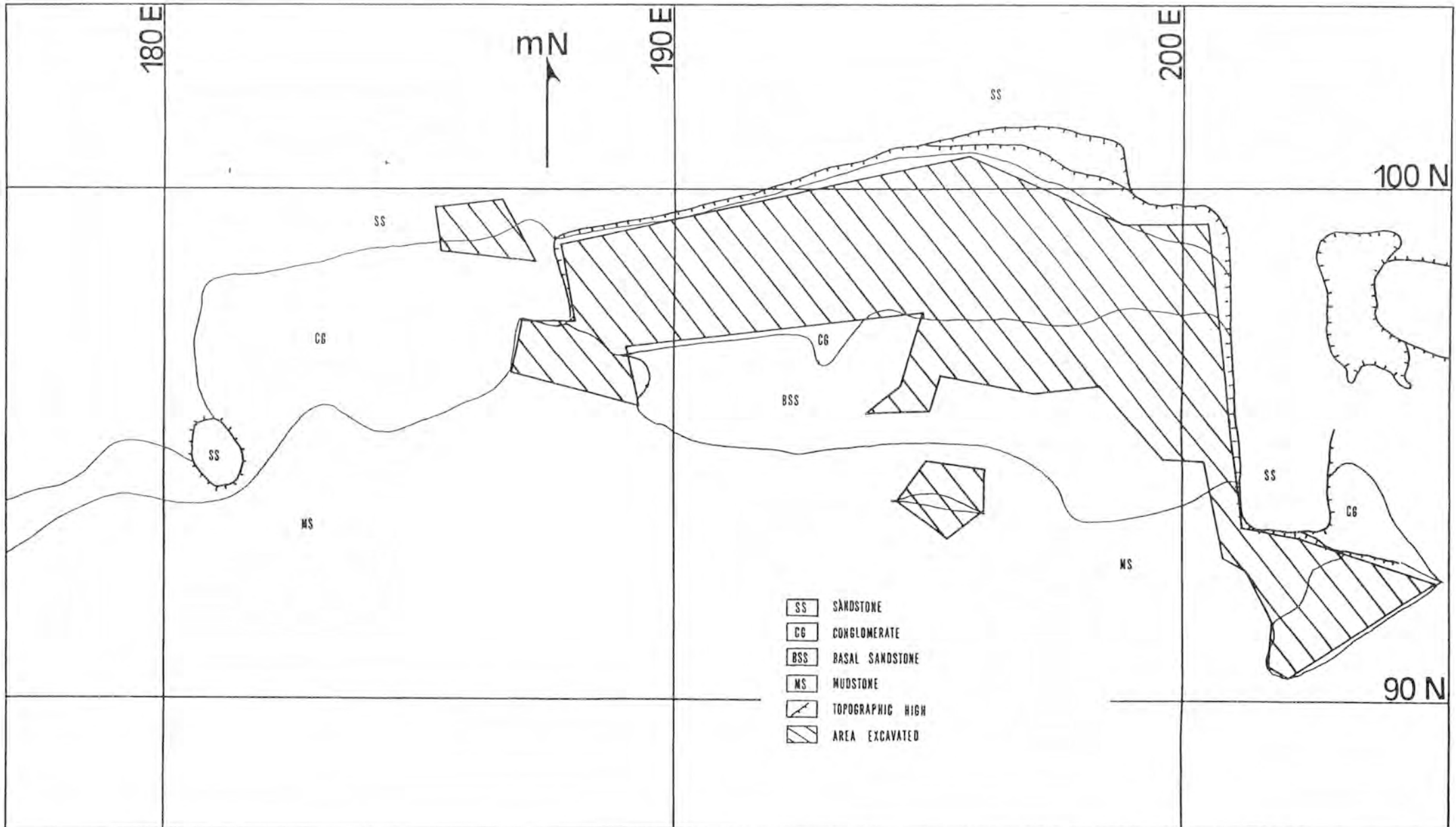
MAP: NICK VAN KLAVEREN

DRAWN: 18/3/97

MAP 2



Progressive Excavation Areas
March 1997



- SS SANDSTONE
- CG CONGLOMERATE
- BSS BASAL SANDSTONE
- MS MUDSTONE
- TOPOGRAPHIC HIGH
- AREA EXCAVATED

MAP NICK VAN KLAVEREN

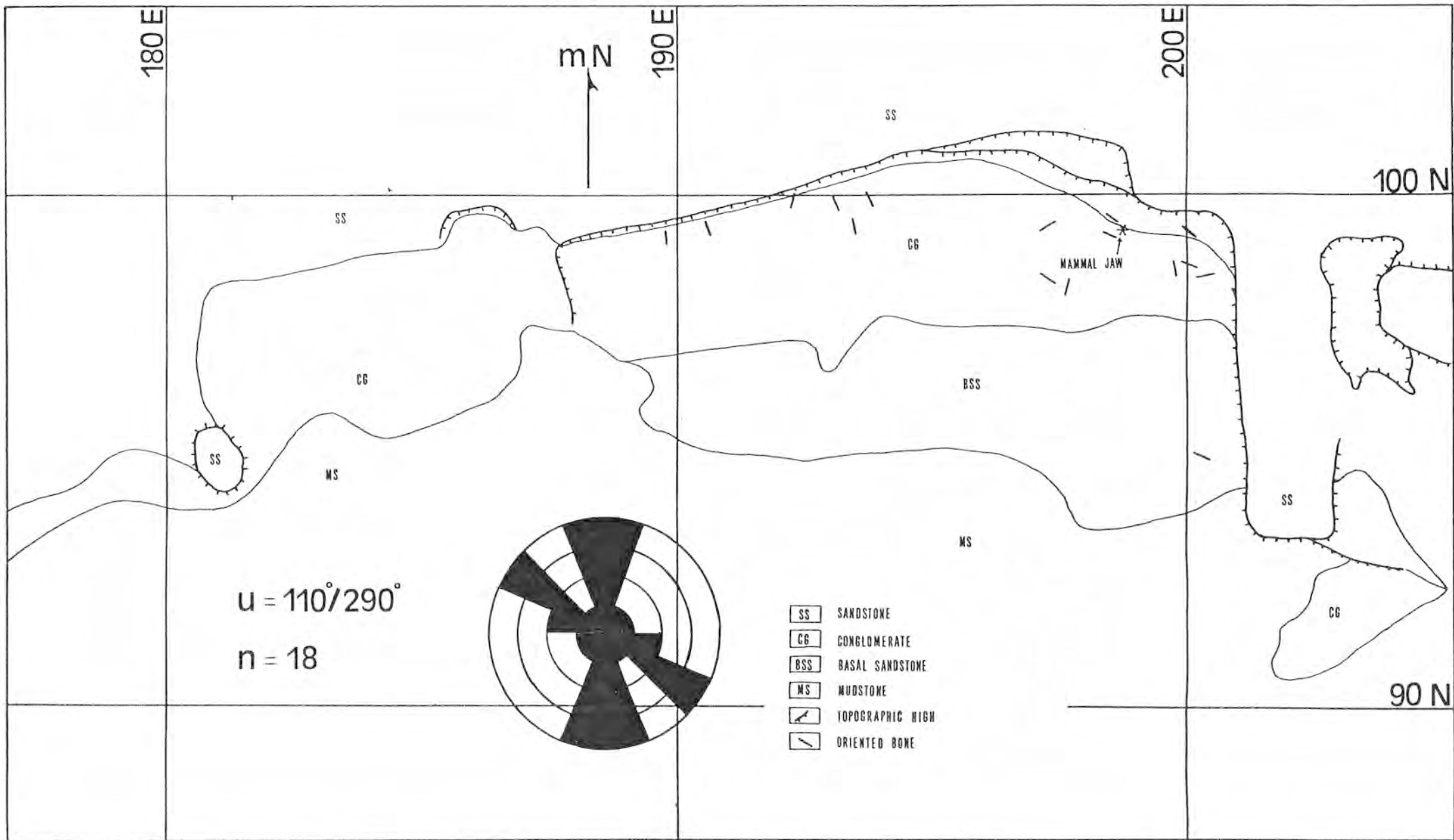
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MAP 3



Cumulative Excavation Areas

March 1997



MAP: NICK VAN KLAVEREN

DRAWN: 18/3/97

MAP 4



Cumulative Limb Bone Orientations
Flat Rocks Site, Inverloch 1997