

RB 47/161

DEPARTMENT OF MINES - SOUTH AUSTRALIA.

HYDROLOGY OF THE HUNDREDS OF TATIARA AND WIRREGA

By

R. I. CHUGG

ASSISTANT GEOLOGIST.

ASSOCIATED PLANS: 52-53 A
TO
52-53 E

---000---

MICROFILMED

DEPARTMENT OF MINES - SOUTH AUSTRALIA.

HYDROLOGY OF THE HUNDREDS OF TATIARA AND WIRREGA.

I. SUMMARY

The Hundreds of Tatiara and Wirrega in the Central Murray Basin include densely developed sheep and wheat areas.

Gradually decreasing elevation from the east to the west is interrupted by two systems of ridges in the west.

Supplied with approximately twenty inches of rain a year, the area is partially drained by two streams flowing to the west and contains numerous swamp areas in the wet seasons.

Clayey loams to sandy soils support mallee-broombrush vegetation and heavier timber on the swampy ground.

Tertiary and Quaternary sands, clays and limestone deposits of 600 feet thickness overlie pre-Cambrian schists at Bordertown. The only pre-Tertiary rocks exposed are three granitic outcrops in the western third of the area.

A bed of Bryozoal limestone is the main aquifer in which excellent stock water is almost invariably found. In the north western portion of the Hundred of Wirrega, useful water is found at shallow depths in unfossiliferous sands, limestones and sandstones.

Surface drainage through runaway-holes, and to a lesser extent, through drainage bores, into the groundwater has a marked local "freshening" effect.

II INTRODUCTION

The two Hundreds lie in that portion of the Murray Basin to the west of the Ninety-Mile "Desert", and between the Big "Desert" on the north and the Little "Desert" to the south.

This area of about 450 square miles is well traversed by a network of roads and lanes. Highways connect Bordertown with Adelaide and Melbourne while Bordertown, Wolseley and Custon are linked by railways to Adelaide, Melbourne and Naracoorte.

Much of the area is under intensive wheat and wool production. Dairying and lucerne irrigation are of growing

importance. Some vegetable and fruit irrigation has been carried out successfully on a commercial basis.

A hydrological survey was made in the area from December, 1951 to 24th April, 1952.

III PHYSIOGRAPHY AND CLIMATE

Decreasing elevation from the east to the west boundaries are marked by gentle undulations and occasional low sand ridges. In the Hundred of Wirrega more pronounced ridges of apparent consolidated dune limestone, capped with travertine limestone, occur. In the south-eastern portions of the Hundred they run approximately N.N.W., while to the north-west, N.E. directed ridges are present. Swedes Flat in the south-west of the Hundred of Wirrega occurs as a flat valley between high ridges of a N.W., direction. The Kongal Rocks form a prominence of granitic rock.

A Mediterranean climate of summer droughts and winter rains provides a mean annual rainfall of about 19 inches at Bordertown, increasing to over 20 inches west of Mundalla. Trumble's (1) compilation of 63 years of rainfall records for Bordertown shows 7.5 season months of useful rain and a drought frequency of 14%, when there are less than five months of continuous useful rainfall.

IV VEGETATION AND SOILS

The Hundreds include a belt of generally heavier soils which vary in type with the topography. The belt lies between the Big and Little "Deserts" and extends on into Victoria. These fertile soils and their accompanying vegetation of bull-oak, peppermint gum, blue gum etc., are in marked contrast to those of the surrounding Deserts. Across the southern portions of the Hundreds a mallee-broombrush soil occurs. A description of the soil and vegetation types are given by Specht(2).

V GEOLOGY

A. Pre-Cambrian

Pre-Cambrian schists, gneisses etc., overlain by Tertiary and Quaternary sediments have been determined over a wide area around these Hundreds. The Bordertown Government Bore (No.104A, Hundred of Tatiara) struck pre-Cambrian schists at a depth of 600 ft..

B. Oligocene

The Bordertown Bore (No.104A) is the only bore in the Hundreds penetrating through the Oligocene. Here, over three hundred feet of lignitic and pyritic sands, with some sandy limestones, overlie the pre-Cambrian rock.

C. Bryozoal Limestone

Middle (?) Miocene. The Bryozoal limestone bed is the prominent Miocene formation in this area and constitutes the most important aquifer. Accompanying sections and contours indicate that it is continuous over most of the two Hundreds. From a height of over 260 feet above sea level in the south-east near Custon it decreases in elevation toward the west and north.

Little information of this formation was obtainable in the north-west portion of the Hundred of Wirrega where bores obtain ample good water without penetrating the bryozoal rock.

D. Post Bryozoal Limestone to Recent

These deposits of marine, fluviatile and aeolinate origin vary in thickness from less than 30 feet to over 100 feet on the levels and constitute various successions of sands, gravels, gritty limestone and clays. There is frequently a capping of travertine limestone just below the soil.

Accompanying sections show undulations in the top of the bryozoal reef roughly paralleling the surface contours. This suggests to the author the possibility of recent and Pleistocene aeolinate deposits building up as ridges on prominences of earlier marine and fluviatile beds following the Pleistocene regression of the sea.

E. Igneous

Three granitic outcrops occur in the Hundred of Wirrega. The Kongal Rocks, section 415, rise to a height of about 320 feet above sea level and cover several acres in extent. The others of lower relief were inspected on sections 423 and 297. These rocks are described by Mawson and Dallwitz (3) as being of early Palaeozoic age and part of the Murray River Batholith.

D. Faulting

The above igneous outcrops and the Padthaway Horst Escarpment indicate a fault or faults between these outcrops and the Bordertown Government Bore (104A, Hd. Tatiara).

The igneous rocks in the west have a positive displacement relative to Bordertown of approximately 500 feet.

VI HYDROLOGY

A. Drainage and Intake to Underground Water

Two intermittent streams drain westward from near the Victorian border. Surface water also moves from the south east of the Hundreds in broad, shallow, undefined courses forming temporary swamps.

The northern stream, the Tatiara Creek, empties into the Poocher Swamp in the winter. The Poocher runaway-hole drains this swamp into the underground water by an opening into the bryozoal limestone. When the swamp is drained the static water level is clearly visible in the cone-shaped hole.

To the south, the Nalang Creek terminates in the Mundalla Swamp. A series of runaway-holes on Section 722, Hundred of Wirrega, drain this swamp of about 800 acres in a matter of two or three days, once the water pressure has broken free the debris closing the holes. The water passes into the cavernous bryozoal limestone with a roar said to be audible a mile away.

The shallow flood waters from the south-east of the Hundred of Wirrega swing westward, west of Mundalla, and are finally channeled along with other waters to flow parallel to the Cannawigara Road. These waters and other local swamps are drained into the groundwater by other runaway-holes and drainage bores. In the north-west of the Hundred where drainage is poor, these waters apparently percolate down through sands and limestone and are held at shallow levels.

B. Aquifers

1. Bryozoal Limestone

Except for the north-west quarter of the Hundred of Wirrega where upper waters are used, the bryozoal limestone is

the main aquifer. Useful water is generally cut near the top of the bryozoal reef and seldom rises appreciably. Supply has seldom been a problem for up to ten or twenty thousand gallons an hour. Despite the heavy pumping the general water level is very little affected.

The limestone is quite porous and often contains cavities a few inches thick or more. Caverns up to 12 feet in thickness have been reported. Frequently there is a hard crust of consolidated limestone at its upper few inches.

Reference to the piezometric contours indicate that the direction of flow of water in this aquifer is generally to the west.

It is, however, uncertain what happens to this water in the north-west portion of the Hundred of Wirrega.

Considerations are as follows:-

- (a) There is a considerable quantity of water flowing westward through the porous bryozoal limestone aquifer under little or no pressure.
- (b) Bryozoal limestone was not definitely determined in the shallow bores and wells west of Section 235 and north of Section 404. Two shallow waters have been cut on Sections 67 and 110B, but the lower water is not established as being in the bryozoal aquifer.
- (c) The Padthaway Horst Escarpment is found at the western boundary of the Hundred of Wirrega in the vicinity of Sections 423, 432 and 433.
- (d) The existence of this escarpment and the igneous outcrops on sections 415, 423 and 297 in the Hundred indicates at least one fault between these outcrops and Bordertown.
- (e) All year round springs were not found during the survey.

It would seem either that the direction of flow is diverted by the horsts and faults, or that the igneous horsts do not present a continuous barrier to westward moving underground waters.

In most areas in the Hundreds, as indicated by the isohaline contours, the salinity of these waters is suitable for lucerne irrigation. In vicinities where surface water has entered

this aquifer, the total salt content is materially reduced.

Nitrate and Nitrite radicles appear in the analyses of waters near drainage bores and runaway-holes.

2. Pre-Bryozoal Limestone

Only in a few instances has boring proceeded past the bryozoal limestone. Water was cut three times in the old Bordertown Bore (No.104A) in pre-bryozoal rock with total salinities ranging from 88 to 105 grains to the gallon. The continuity of the facies of lignitic and pyritic sands and sandy limestone found at this bore is not known.

It would seem probable that useful waters could be found past the bryozoal limestone aquifer over most of the Hundreds, excepting perhaps the western portion of the Hundred of Wirrega. However, these lower aquifers are not considered to constitute a necessary source at the present as good quality water is generally found at shallower depths.

3. Post Bryozoal Limestone

Excepting the north-west portion of the Hundred of Wirrega, water is seldom cut above bryozoal limestone water.

Sand hill soaks are occasionally found and sometimes provide a useful source of good quality water of limited supply.

Perched water above clay lenses has been cut. This water is normally cased off as it is usually said to be salty. The occurrence of upper levels of salt water in these Hundreds is not a common hazard in boring operations.

In the north-west quarter of the Hundred of Wirrega water is found from five to thirty feet below level ground in white, gritty limestone, sands and sandstones. Few bores in this area have penetrated past this first water which is usually adequate in supply and quality. The division between bryozoal limestone water and the upper aquifer is obscure. Continuity of the salinity pattern suggests some intermingling of the water. What information is available suggests that this shallow water lies above the bryozoal aquifer, which may be a less regular deposit in this area. Sources for this water are the downward percolating surface waters from the east and run-off from the high escarpment of the Padthaway Horst

from the west.

VII UTILIZATION

A. Stock

Fine stock water is pumped extensively over most of the area.

B. Irrigation

A number of power driven pumps in recent years have been supplying irrigation water for lucerne. Adequate supplies of suitable quality water at moderate to shallow depths suggests an extension of this practice.

Very little commercial irrigation has been attempted for fruits or vegetables. The success of many domestic gardens is an indication of the possibilities, given a suitable market. Schiller Bros., on Section 374 and 364 of the Hundred of Wirrega, have grown, commercially, a number of varieties of fine apples.

Some lucerne has been grown, without irrigation, in areas with groundwater at shallow depths.

C. Domestic

Most farmers have rain tanks for all domestic purposes other than their gardens. Some bore water is quite suitable for washing and drinking as indicated by the present supply for Bordertown (Bore No. 74, Hundred of Wirrega). Care must be taken near runaway-holes and drainage bores to avoid possible pollution.

VIII REFERENCES

1. TRUMBLE, H.C. Waite Agricultural Research Institute.
Reprint from JOURNAL OF AGRICULTURE, Sept., 1948.
"Rainfall, Evaporation and Drought-Frequency in S.A."
2. SPECHT, R.L. Trans.Roy. Soc. S.Aust. 74(1) 1950.
"A Reconnaissance Survey of the Soils and Vegetation of the Hundreds of Tatiara, Wirrega and Stirling of County Buckingham".
3. MASON, D. and DALLWITZ, Trans.Roy.Soc.S.Aust. 68(2) 44
"Palaeozoic Igneous Rocks of Lower South Eastern South Australia".

No. _____
 Amendment _____
 Exd. _____
 Date _____

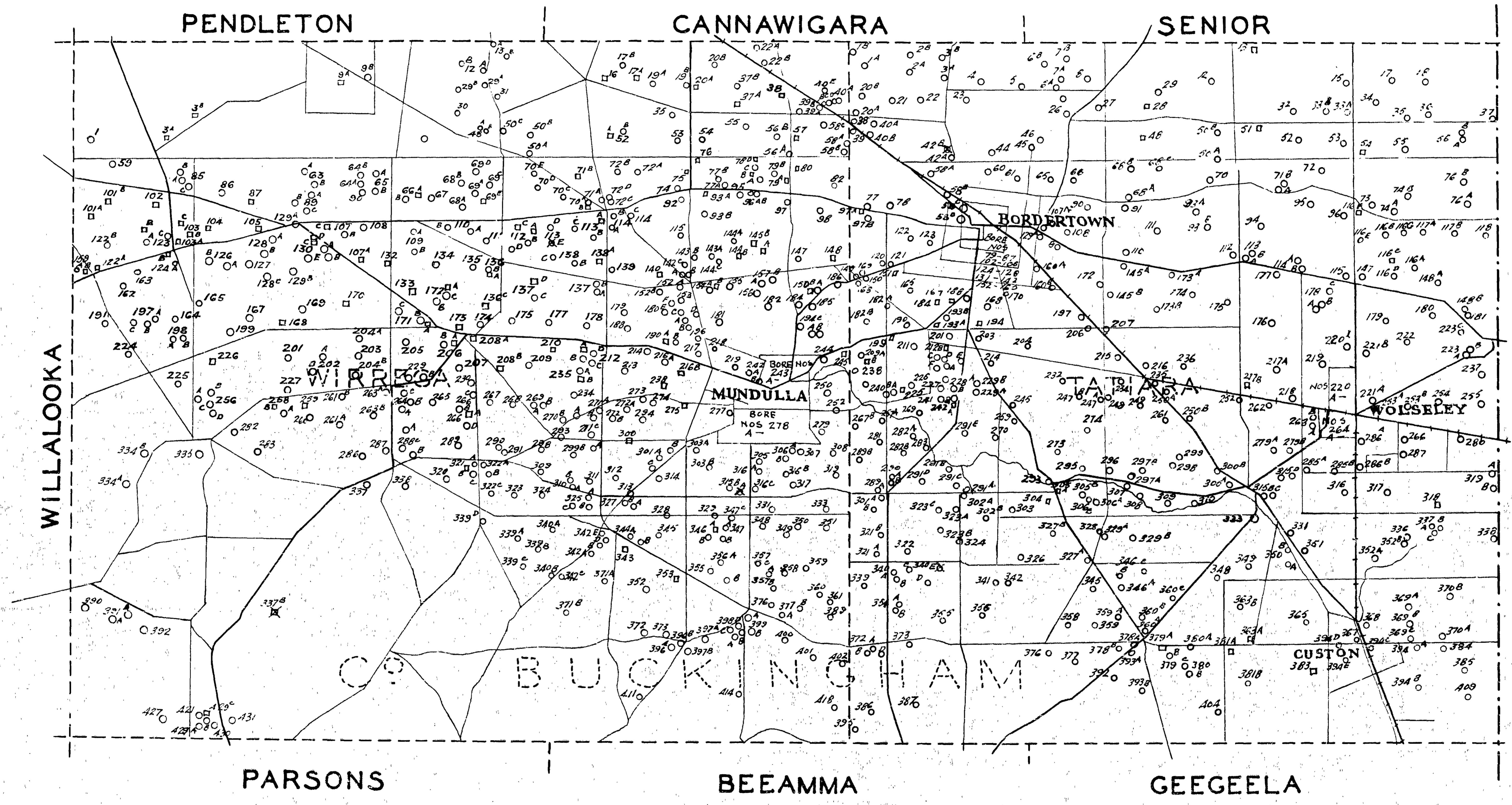
HDS TATIARA & WIRREGA

S. A. DEPT. OF MINES
 HYDROLOGY

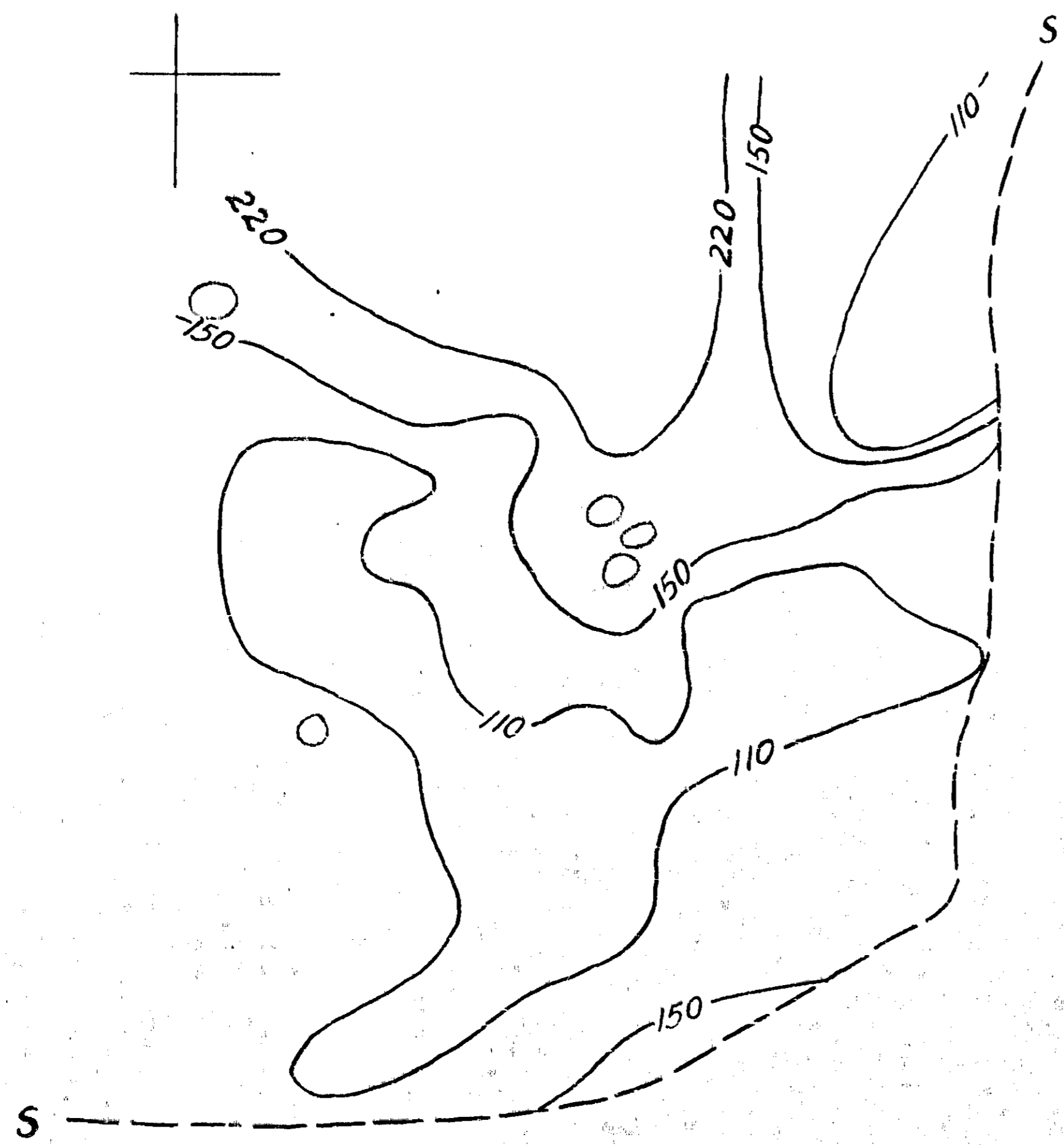
Approved _____
 Passed _____
 Director _____

Dr. J. M. C.
 Ted J. M. C.
 Ckd. R.R.
 Exd. _____

Scale: 1" = 2miles
52-53
 Hb7/8
 Date 6-2-52



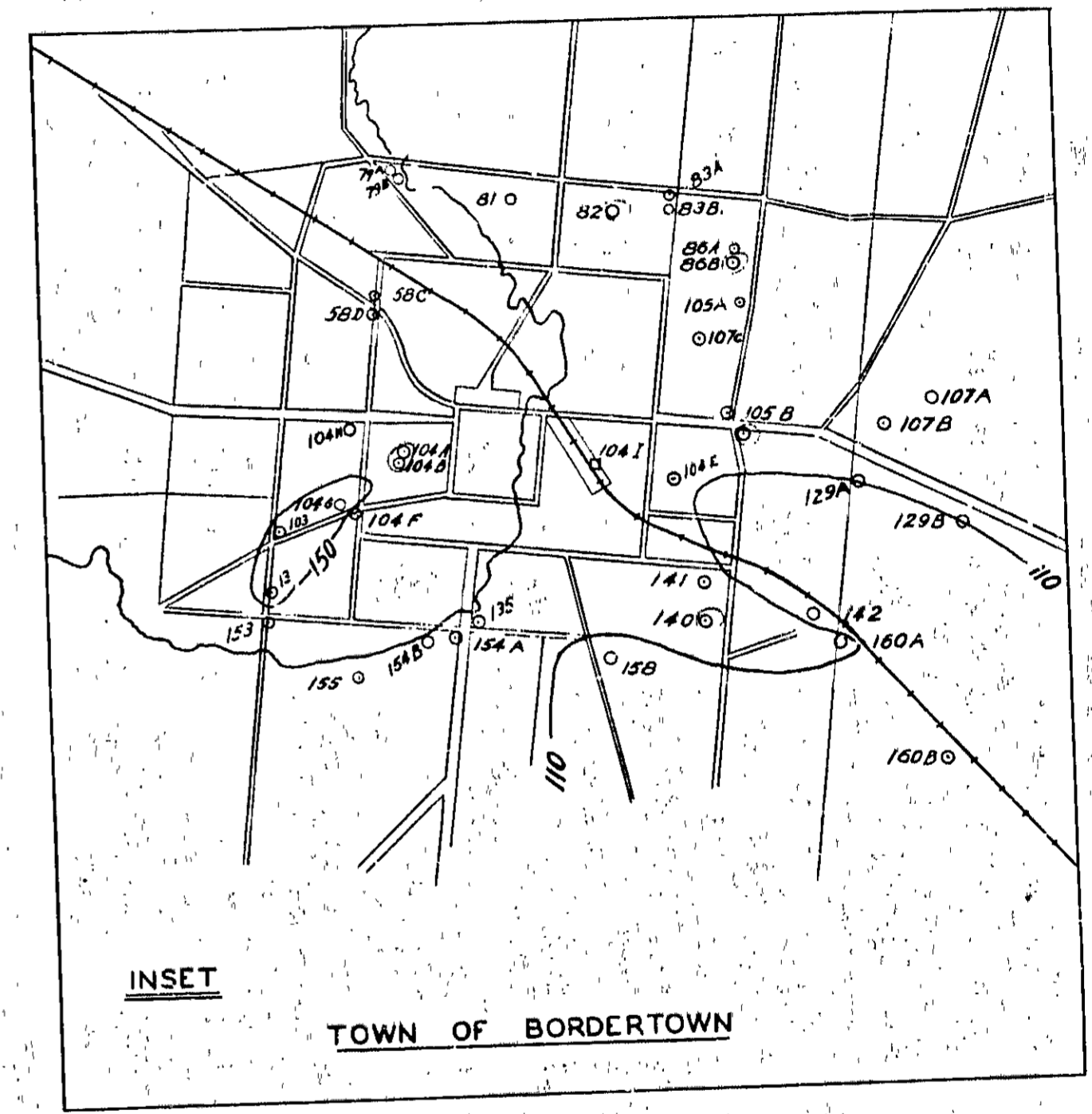
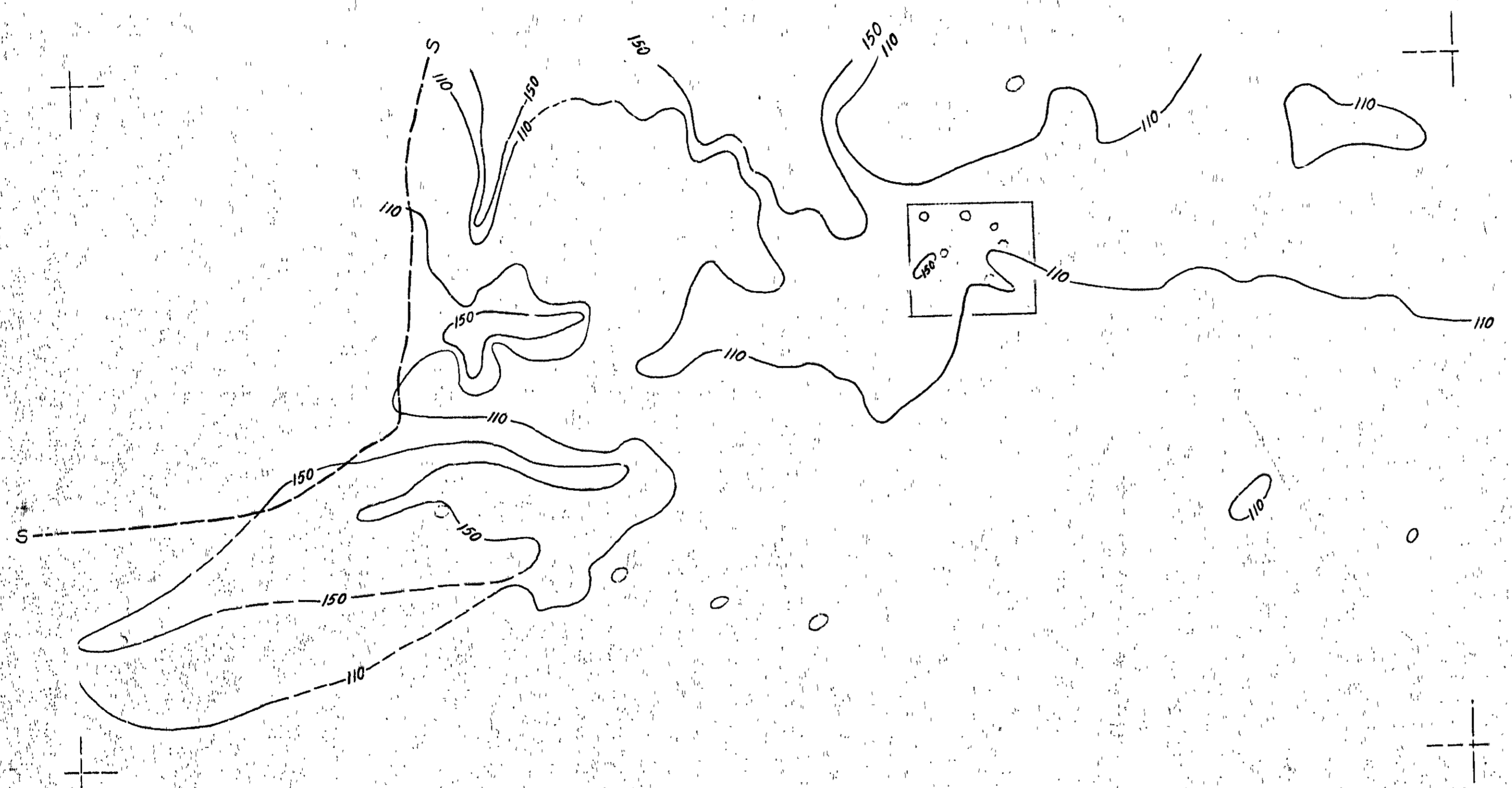
VICTORIA



0-110	grains per gallon	<input type="checkbox"/>
110-150	" " "	<input type="checkbox"/>
150-220	" " "	<input type="checkbox"/>
220-330	" " "	<input type="checkbox"/>
330-440	" " "	<input type="checkbox"/>
440-550	" " "	<input type="checkbox"/>

Isohalines
Approx. limit of shallow ground water

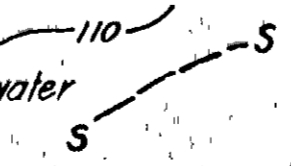
52-53A
 H 5/8



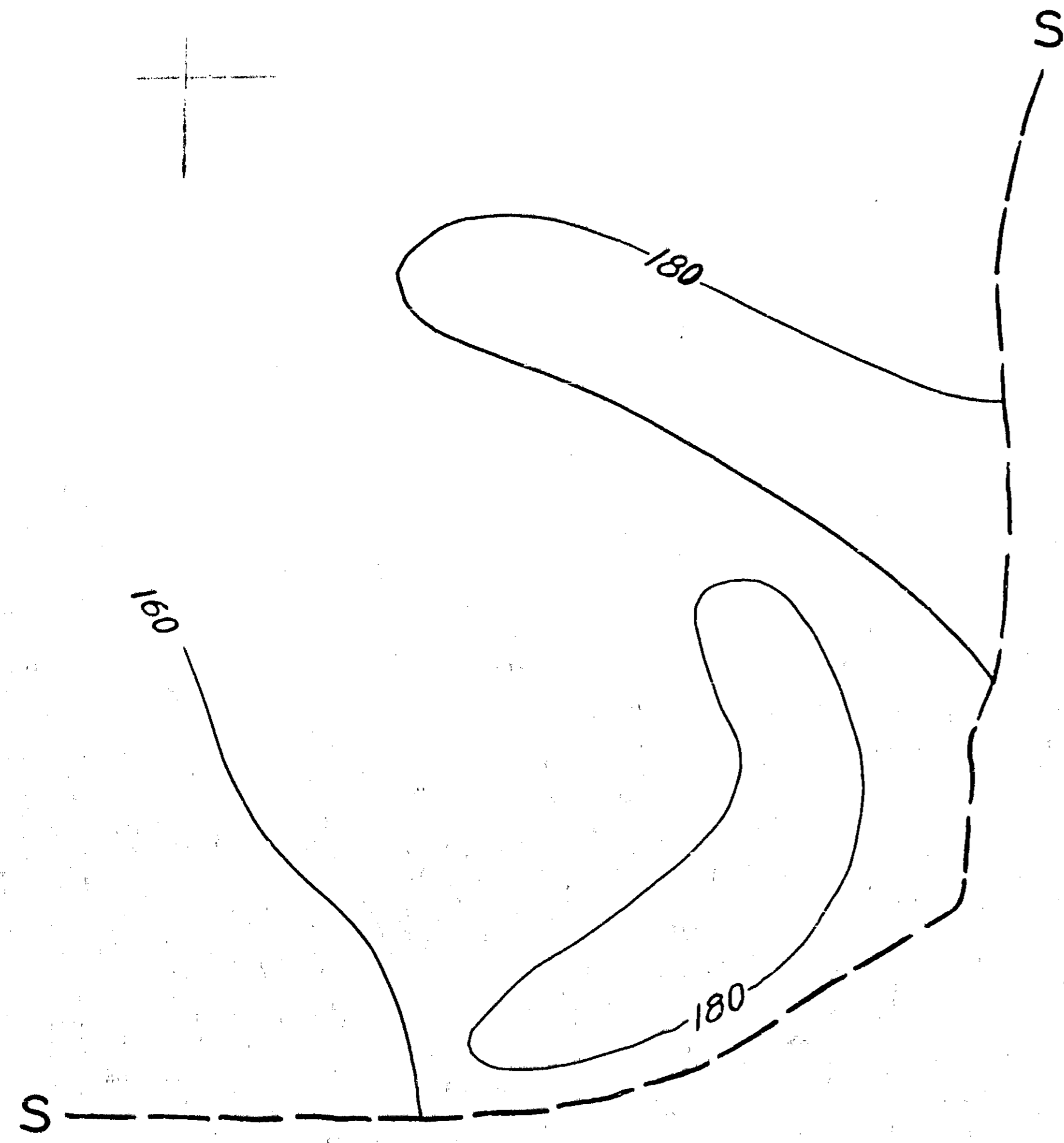
ISOHALSINES
BRYOZOAL LIMESTONE AQUIFER

0-110	grains per gallon	
110-150	"	
150-220	"	
220-330	"	
330-440	"	
440-550	"	

Isohalsines
 Approx. limit of shallow ground water



PIEZOMETRIC CONTOURS

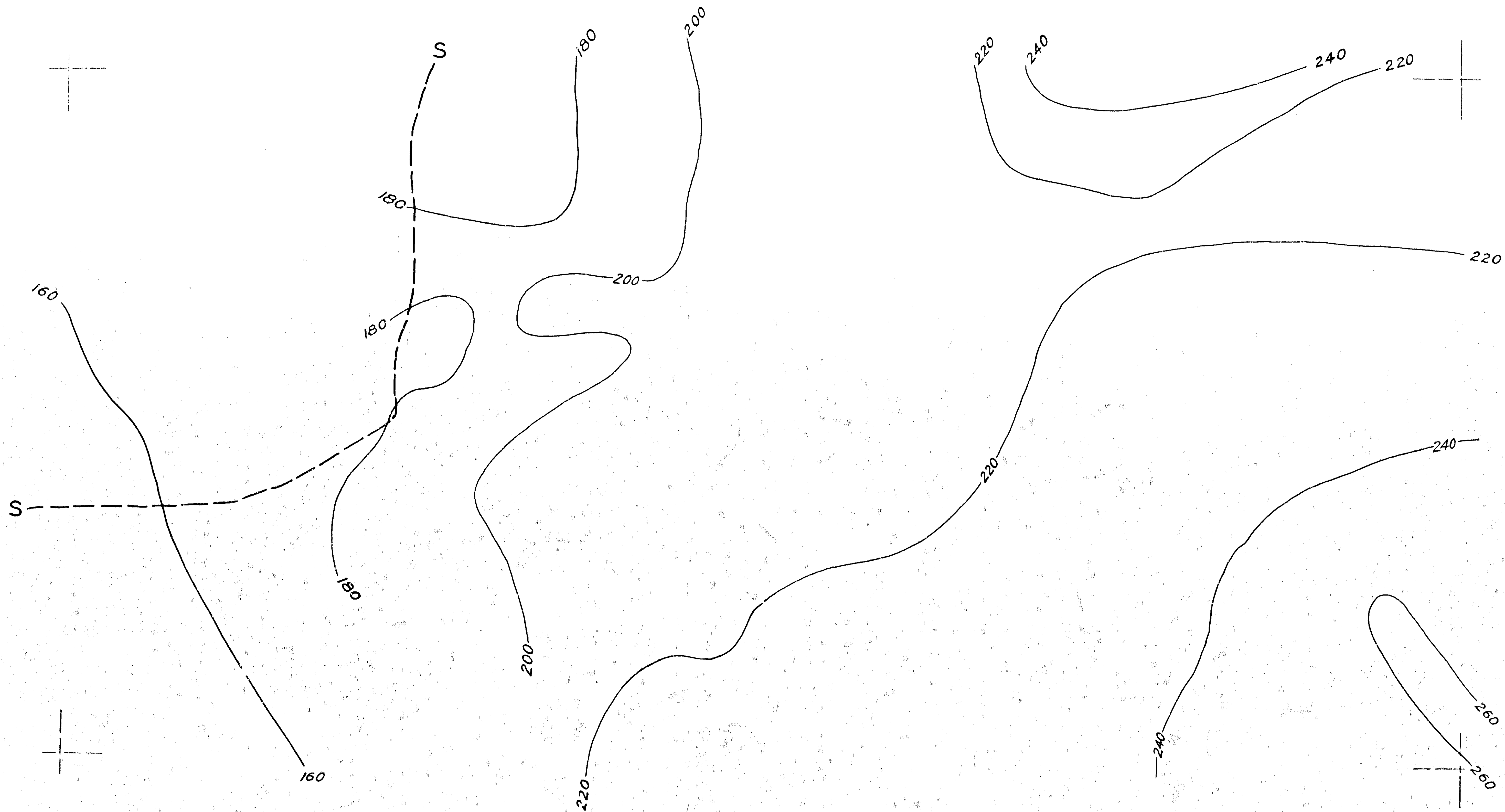


PIEZOMETRIC CONTOURS
POST BRYOZOAL LIMESTONE WATERS

Approx. limit of Post Bryozoa water

A legend showing a dashed line with 'S' labels at both ends, corresponding to the dashed line in the main map.

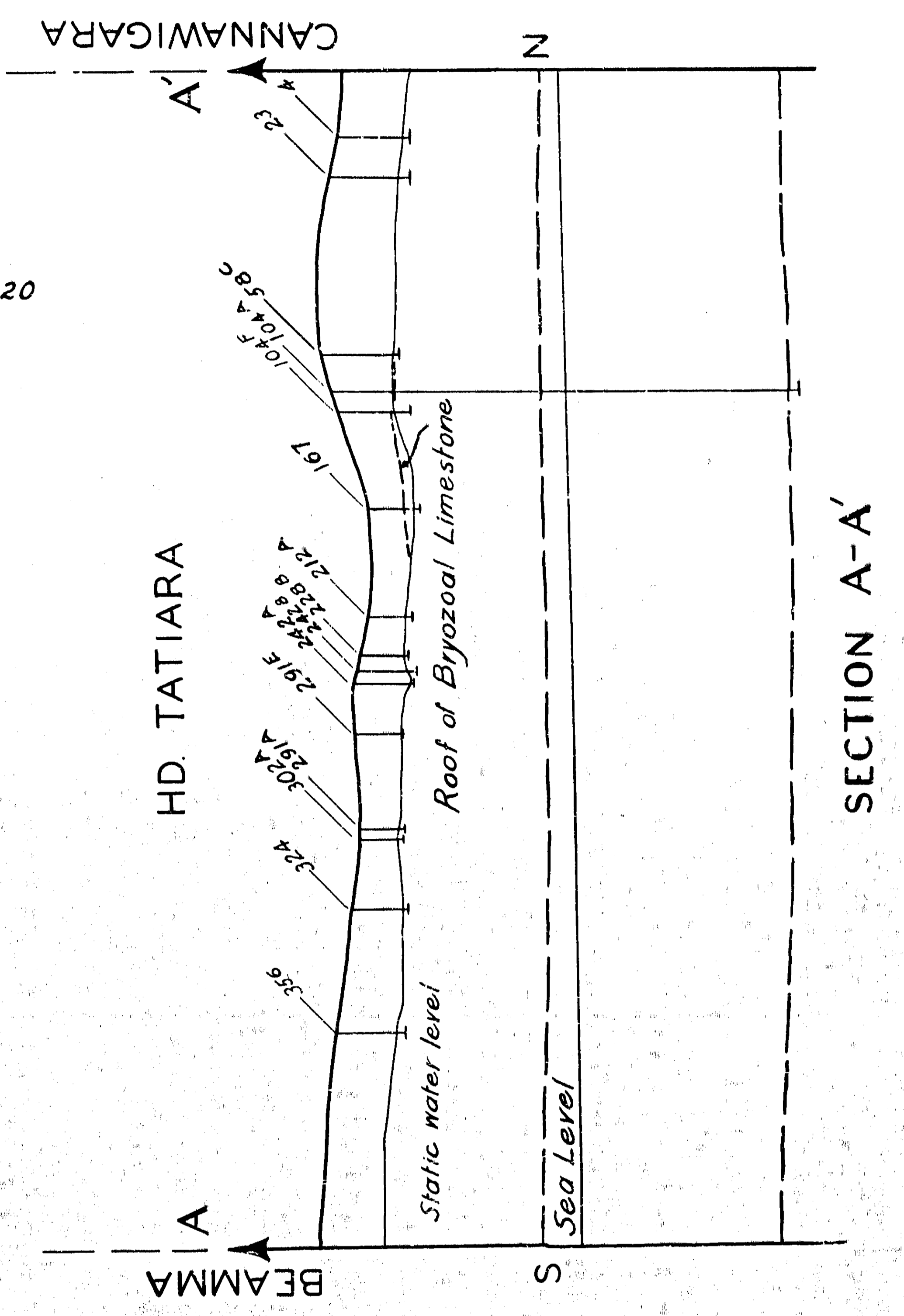
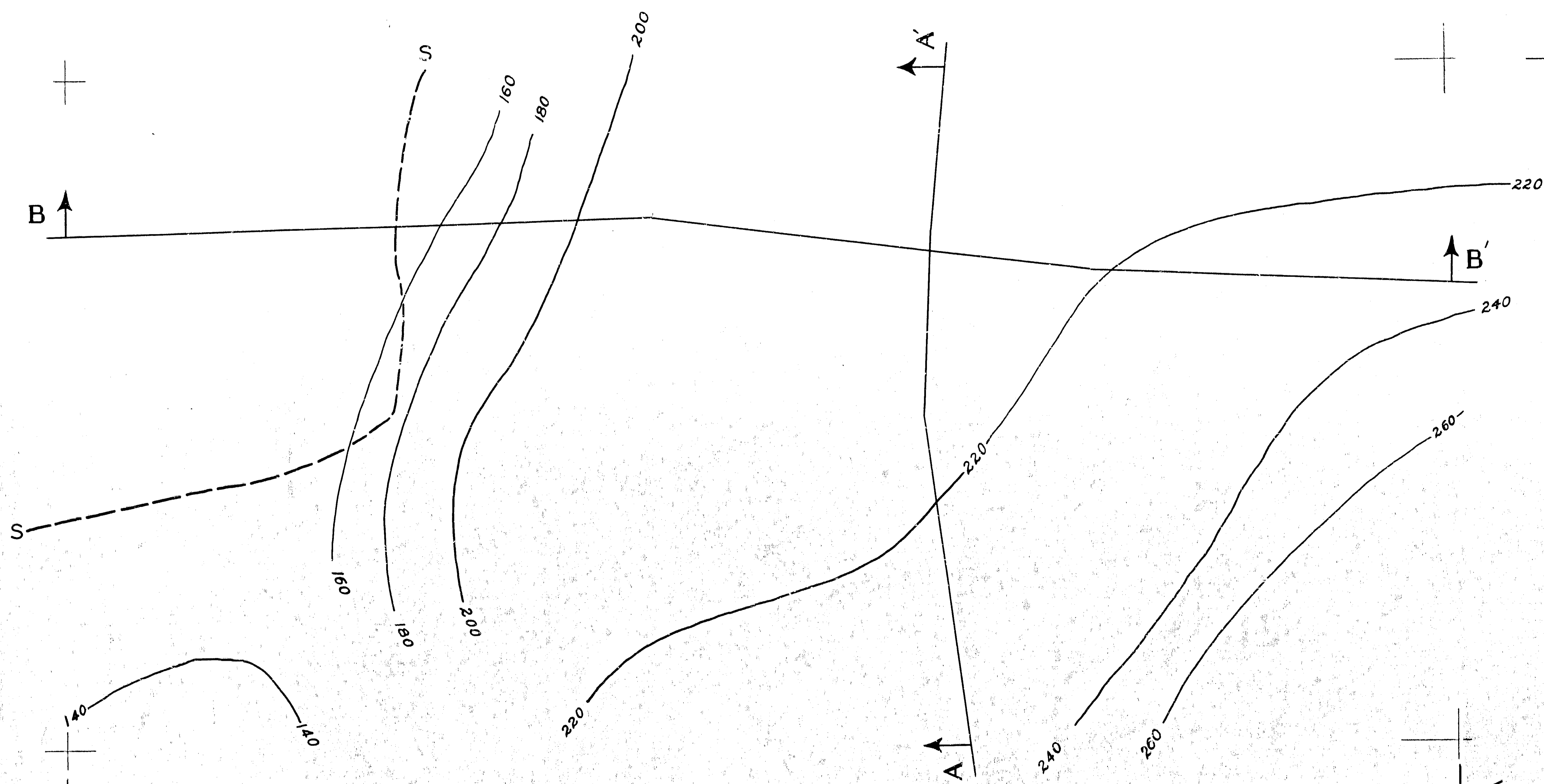
PIEZOMETRIC CONTOURS



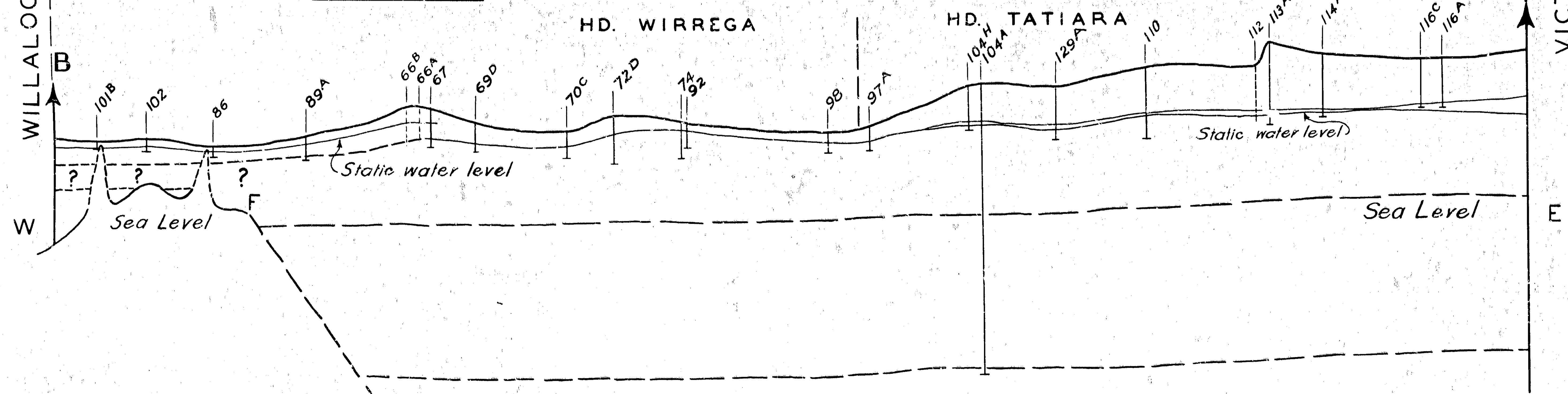
PIEZOMETRIC CONTOURS

BRYOZOAL LIMESTONE WATER

S *S*
Approx limit of Bryozoal water



CONTOURS — ROOF OF THE BRYOZOAL LIMESTONE REEF



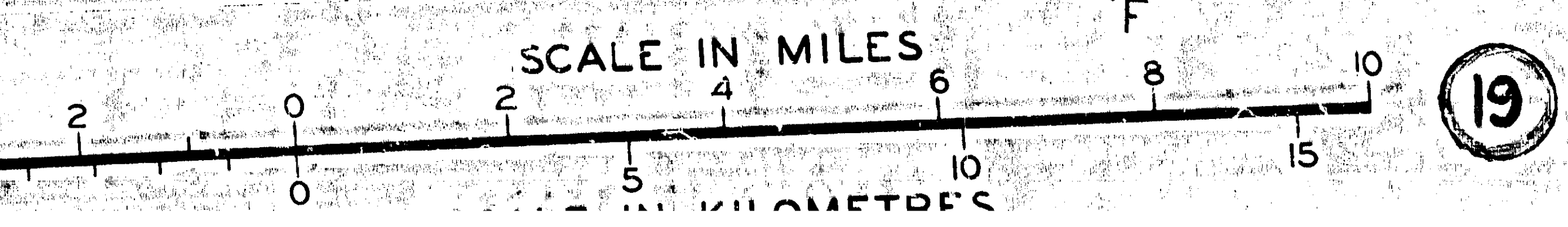
LEGEND

- Recent-Upper Miocene
- Middle Miocene-Lower Miocene
- Lower Tertiary
- Pre Cambrian
- Igneous
- Suspected Fault

SCALE

HORIZONTAL 1 inch to 2 miles

VERTICAL 1 inch to 200 feet



SECTION B-B'