

GEOMAGNETIC SURVEY  
OF  
ROLETTE AND TOWNER COUNTIES,  
NORTH DAKOTA

by  
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INTRODUCTION

This survey was undertaken at the instigation of Dr. Wilson M. Laird with the view of obtaining a general idea of possible subsurface structures in the area surveyed. Any such information, if determinable, was judged to be of help in the present search for petroleum. This work was begun near the end of June, 1951 and continued until the end of August. Frequent and violent magnetic storms did not permit an earlier start.

INSTRUMENTATION

The instrument used was a Schindt type vertical intensity magnetometer, No. 1063, manufactured by Sprengnether and Company. This instrument did not have the precision of instruments ordinarily employed in commercial work, but has served well the purpose for which it was intended. Calibration of this instrument has shown that within the temperatures experienced, temperature corrections would be negligible; therefore, no such corrections have been made.

The instrument was adjusted to a fairly large scale value, which explains omission of temperature corrections. This scale value was maintained during the survey at between 86 and 91 gammas per scale division. Scale value adjustments were made by either Helmholtz Coil or Auxiliary Magnet methods. During the survey, a defect developed in the coil, and

during the latter part of the work, the auxiliary magnet method was used exclusively. This, of course, necessitated periodical evaluations of the magnetic moment of the auxiliary magnet to insure against any variations due to histeresis.

Latitude and longitude corrections were made in the following way: The instrument was first adjusted for the latitude of Cando, which was almost in the central location. Additional corrections were made by subtracting 10 gammas per mile if the survey advanced northward and by adding a similar amount if the traverse was carried southward. Longitudinal correction consisted of adding 3 gammas per mile in a westerly direction and subtracting the same amount from easterly traverses. Rechecking of the instrument in Rolla indicated that such corrections were sufficient.

Diurnal variations, as a rule very large, were corrected by frequent checks on bases and sub-bases. Such checks had to be made at intervals ranging from 2 hours to 20 minutes, the interval depending on atmospheric conditions. Magnetic storms necessitated frequent interruptions of work and reworking of certain stretches. In one case, a jump in response of over 1200 gammas was recorded.

As a further precaution against errors, all calculations were made from day to day. Thus, any unusual record could be checked and corrected.

#### AREA SURVEYED

This survey has completely covered Rollette and Towner counties and the adjacent parts of Pierce, Ramsey and Cavalier counties. The area is limited on the north by the International Border with Canada, while the southern limit runs east-west through the town of Rugby. On the east, the limit is a north-south line through the town of Starkweather, and on the west the line between Rolette and Bottineau counties and its prolongation into Pierce county.

Altogether, upward of 1,300,000 acres were thus reconnoitered. Wherever possible, traversing was along township lines with readings every mile. Where such stations could not be made, traverse lines had to be shifted one mile one way or the other. In general, however, the same ~~number~~ of stations per township was maintained.

#### TOPOGRAPHY AND SURFACE GEOLOGY

The area is covered with glacial till of Pleistocene age. Thickness of this till is known imperfectly, but probably ranges between a hundred and four hundred feet. At no point there was found exposures of underlying rocks.

Topographical relief is low with the exception of the Turtle Mountains, located in the northwestern part of the area studied, which rises about 200 to 250 feet above the plain on their southern periphery. Lakes are particularly numerous on the Turtle Mountains. Generally speaking, lakes are most abundant in the northern half of the area surveyed. There are few permanent streams, but intermittent streams and lakes are numerous.

#### RESULTS OF THE SURVEY

As a result of this work a geomagnetic map of the area was prepared. The topographic scale is two miles to the inch. Isogam lines, showing variations in vertical component of magnetic intensity, are drawn at 100 gamma intervals. It was thought useful to make several profiles to show the fluctuations in the vertical component of magnetic intensity.

Several conclusions may be reached from a study of this map. (1) There is a definite geomagnetic gradient to the southwest, which may be interpreted as a gradual thickening of sedimentary strata in that direction. (2) An inference may be made as to the structure of the Turtle Mountains

in the northwestern corner of the map. A fairly uniform spacing of isogammas indicated dynamically undistorted sediments, i.e. "no structure" in the general sense of that word. These isogammas do have comparatively high values, but such values must be attributed to the geomagnetic gradient and not to any folding, faulting or injections of extraneous material.

This last is supported by the results of a few shallow holes drilled there by the Ground Water Division of the United States Geological Survey in 1949. Those holes, located on the latitude of Rolla showed excessive thicknesses of glacial till on top of Pierre shale.

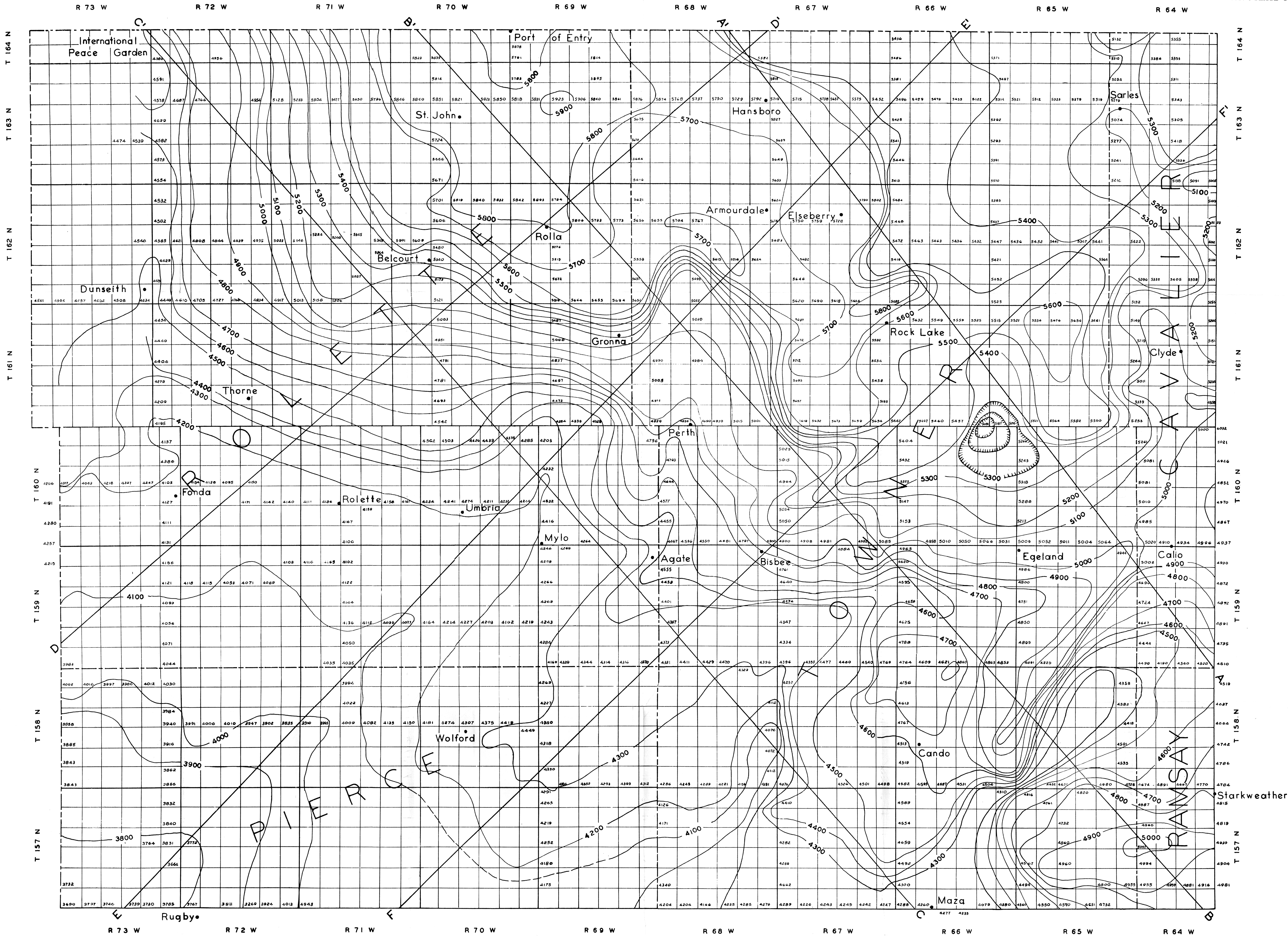
The picture changes between Belcourt and Mylo. There is a sudden widening of isogamma intervals and a consistent drop in values. This is due to a low magnetic susceptibility of deposits the glacial lake "Mylo" that existed there at one time. This lake was outlined on surface in an unpublished report written by the author in 1949. Its deposits cover at least 12 square miles SW of Mylo.

A large magnetic anomaly is evident between Perth and Hansboro. Isogammas configurations suggest an eroded asymmetric anticline. The magnetometer alone, however, cannot decide this question.

Finally, in the triangle with vertices at Egeland, Cando and Starkweather another anomaly is apparent. It might be due to an escarpment or a deeply eroded valley under a covering of glacial till. Results of drilling further east in Ramsey county suggest that this anomaly may be due to an escarpment.

The writer has not attempted to estimate likely thicknesses to "bedrock". While such methods were devised in the past, their practical value is very questionable.



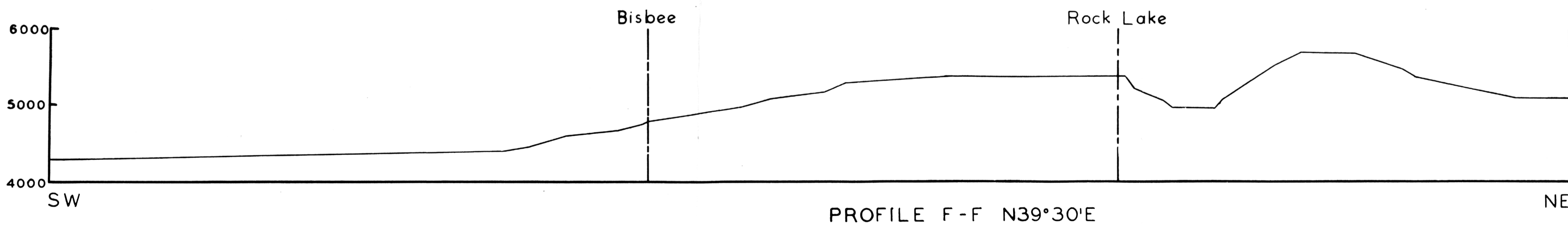
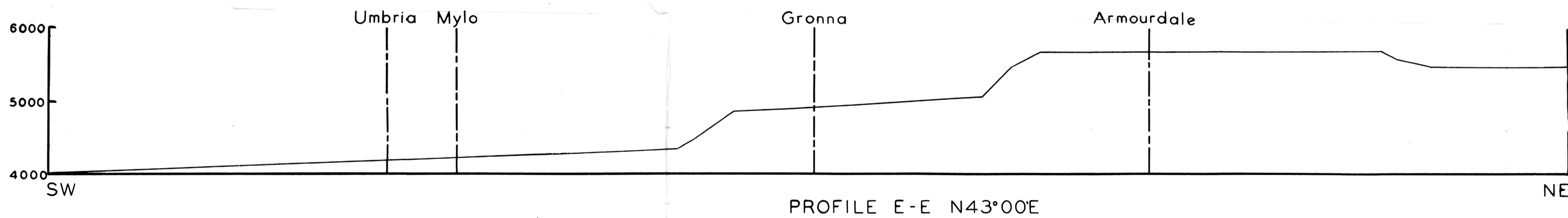
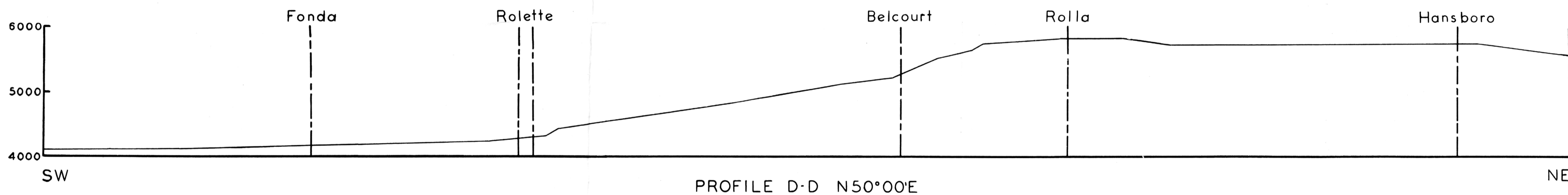
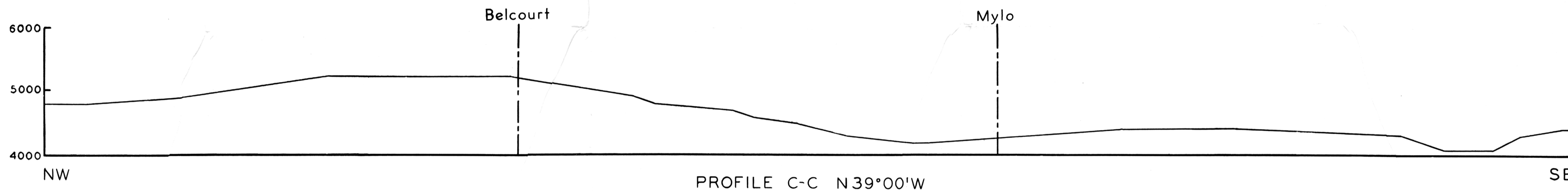
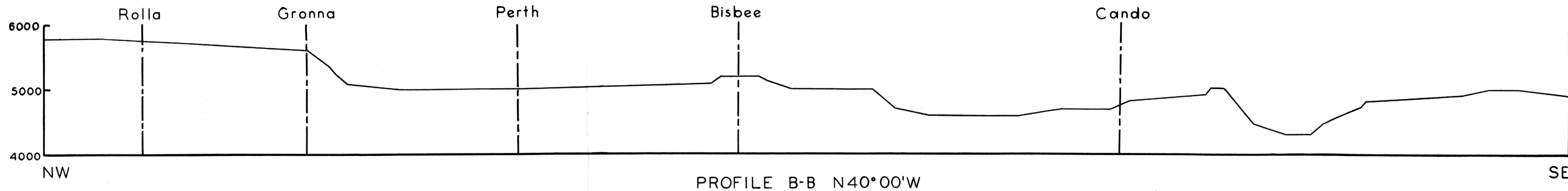
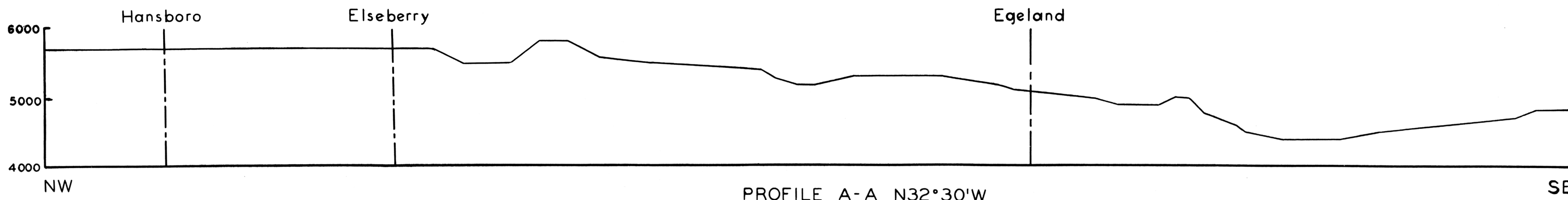


MAGNETIC MAP OF ROLETTE AND TOWNER COUNTIES

Scale: 1 inch = 2 miles. Isoгам Interval = 100 gammas.

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MAGNETIC PROFILES OF ROLETTE AND TOWNER COUNTIES

SCALE: HORIZONTAL 1 inch=2 miles VERTICAL 1 inch=2 gammas

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