should be set up by following techniques on other jobs. Ideally, the project should be photographed and a reconnaissance ground survey should be made before the type mapping specifications are set up. This in most cases will make possible simplification of type specifications and more accuracy.

In all, the final report will contain approximately 250 pages of material by approximately 20 collaborators. We hope to have the maximum possible illustration by actual photographs. The present schedule calls for all detail outlines to be in by March 1. Unedited copy should be ready by September 1 and the final draft by December.

I have attempted in this study to place emphasis on as many new applications of photogrammetry in forest work as I can find, such as the work by John Weir in insect investigations and by Bonneville Power in making right of way estimates.

I will welcome letters about new applications of photogrammetry in forest work and I will try to incorporate such information in the final report should it merit comment.

AIR-PHOTO INTERPRETATION IN NATURAL RESOURCES INVENTORIES*

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Introduction

EARLY last year the author was asked to head the Natural Resources Section of the Photo Interpretation Committee. Owing to circumstances beyond his control, the section has remained very much a skeleton. This is not due to lack of activity in the field of natural resources inventories, both in the United States and Canada, where a large number of projects are underway with a view to evaluating one or another natural resource. For example, in Canada, the provinces of Ontario, New Brunswick, Nova Scotia and British Columbia are all in the process of assessing their forest resources under a joint Federal-Provincial scheme. The basis of this is a rapid general inventory by aerial photography, interpretation and key ground surveys. A similar effort is going forward in the field of soil surveys in all of the ten Provinces. In the United States the U. S. Department of Agriculture, Division of Soil Surveys, has been using air-photographs since the 1920's and since 1930 has made use of photo interpretation as a regular part of its work.[1] The well known Forest Survey of the United States[2] is designed to give a nation wide forest resources inventory. In both countries the techniques of air-photo interpretation have been advancing, and new methods, such as the Forestry Tri-Camera, are being introduced from time to time. However, the main progress has been in the volume of work being done, which speaks well for the growing acceptance by the various controlling agencies, both private and governmental, of the value of the methods.

As the methods of forestry and soil surveys are quite well known, it occurred to the writer that, as a substitute for describing those methods, an inventory of some other or related natural resource might prove of greater interest to the group assembled here. It so happens that his native Nova Scotia, through its Research Foundation, has been conducting inventories on such unusual re-

* Paper read at Nineteenth Annual Meeting of the Society, Hotel Shoreham, Washington, D. C., January 14 to 16, 1953. It was a part of the Report of the Photo Interpretation Committee. Published with the permission of the Nova Scotia Research Foundation.

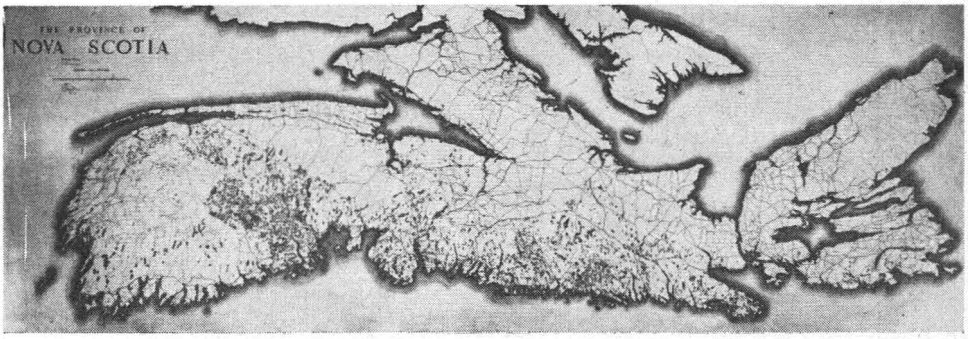

FIG. 1. Pleistocene land form map of Nova Scotia.

sources as seaweed,[3] arable land based on Pleistocene land forms, and, though not unusual, the structural geology of the Province. Because it is one of the three smallest provinces, these surveys are nearing completion, the rapidity being due mainly to air photo interpretation.

For valuable assistance in this work credit is given to the Topographic Survey of Canada, which made available maps on the scale of 1 inch to $\frac{1}{2}$ mile and the base map at 1:475,000. The field sheets of course were compiled from air photos years ahead of the estimates. The bulk of the regional and structural geology was done by the Geological Survey of Canada over the past eighty years. But the assembly of data and the checking of structure, represented by the map, would have been impossible without air-photo interpretation. In addition to compilation and checking, a large number of hitherto unknown geological structures were found in the photo check, ranging from major faults to the only known laccolith in the area.

The seaweed surveys represent a unique effort as far as Canada is concerned. It was, however, directly inspired by similar surveys in Scotland, in which air photo interpretation played a major role.

The survey of Pleistocene land forms was initiated by the Nova Scotia Re-

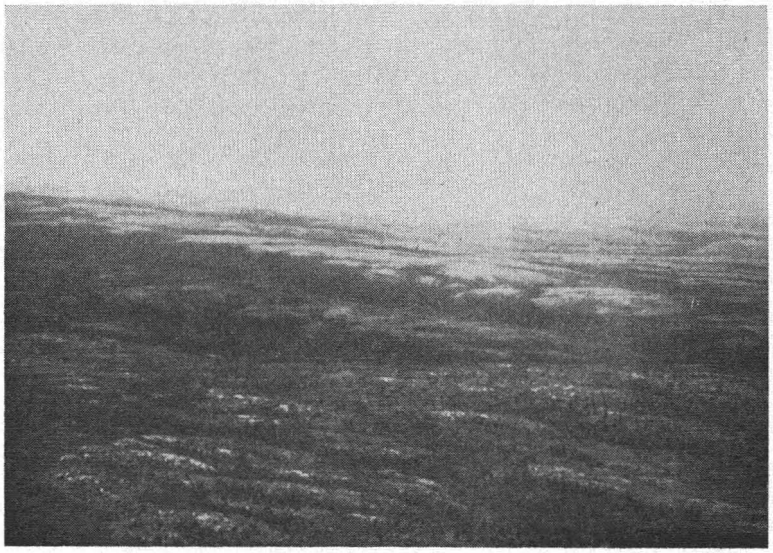

FIG. 2. Glaciated surface North Cape Breton.

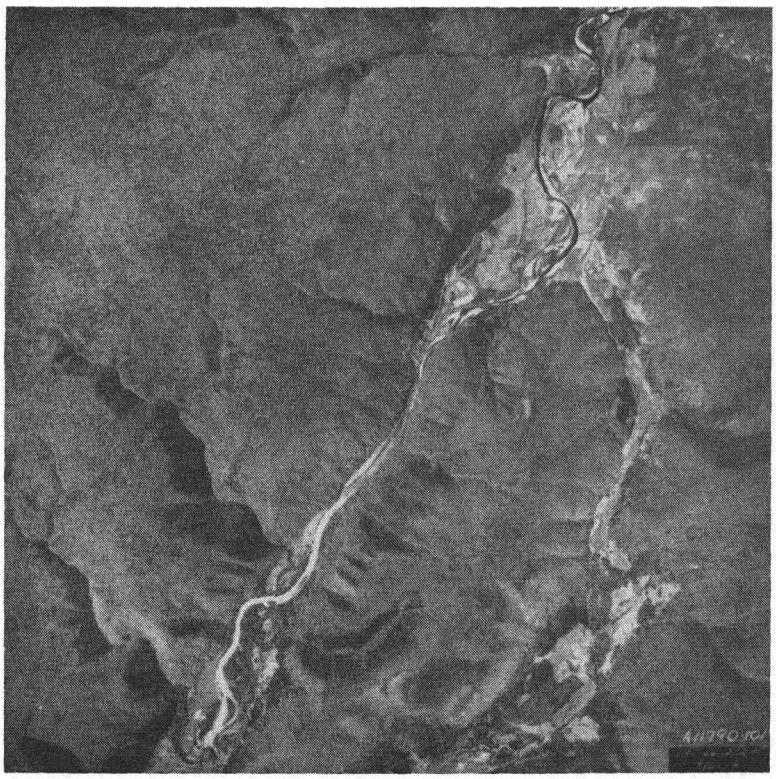

FIG. 3. Glacial Lake Margaree, Cape Breton (Photographic Survey Photo).

search Foundation to fill the gap between the complete soil surveys and the intensive Pleistocene surveys of limited areas carried on by the Geological Survey of Canada. It has already had some practical and scientific success. One area of potential arable land has been mapped and the mapping of eskers and outwash deposits has proven popular with road and other construction workers. Scientifically, it has brought out new evidence of post-Pleistocene changes of sea level and of extensive local glaciation as one of the last episodes of the Pleistocene in Eastern Canada.

SURVEY OF PLEISTOCENE LAND FORMS

Figure 1 is a reduction of a compilation map at a scale of 1:475,000. The northwest sections of Nova Scotia and southeastern New Brunswick are underlain mainly by Pennsylvanian and Mississippian rocks, which do not yield clays and hence do not show many drumlins. The main features of this area are marine sands and gravels deposited during a post Pleistocene submergence. These give a characteristic air-photo pattern and have been mapped over large areas. They form excellent farm lands.

The Cobequid Hills of pre-Carboniferous rocks form a highland about 800 feet above present sea level. On both the north and south flanks of this highland are many old sea beaches, which have been mapped. The more prominent ones are on the south side and form the only arable land in this section. Eskers, kames ridges and kame terraces, are numerous, particularly in the passes at Parrsboro and Folleigh.

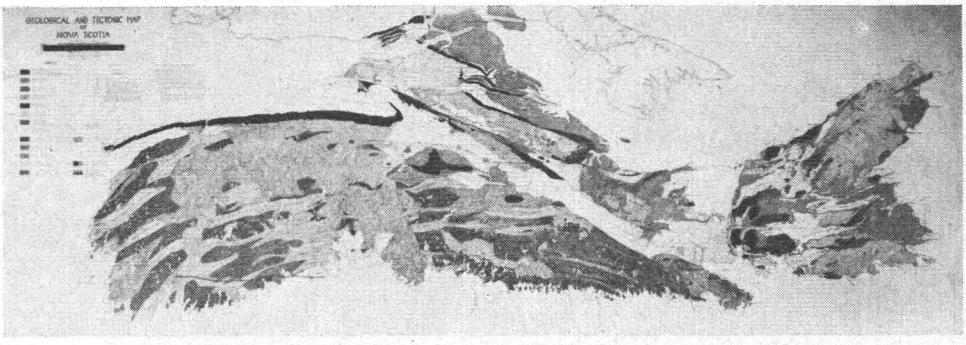

FIG. 4. Geological tectonic map of Nova Scotia.

Southeastern Nova Scotia has a large number of drumlins, mainly due to outcrops of slate bands which yielded abundant clay materials to the glacial advance. The drumlin "field" of Lunenburg-Queens counties shows a very large number of these oval hills for which the orientation indicates the N.W.-S.E. movement of the ice sheet. A close correlation between bedrock and drumlin formation has been noted. Drumlins are numerous on or near clay slate outcrops, while on granite or quartzite the drumlins thin out or disappear. This suggests strongly that the material in drumlins is of local origin. The drumlin field of Halifax-Guysborough was discovered during this survey. It is now mainly under

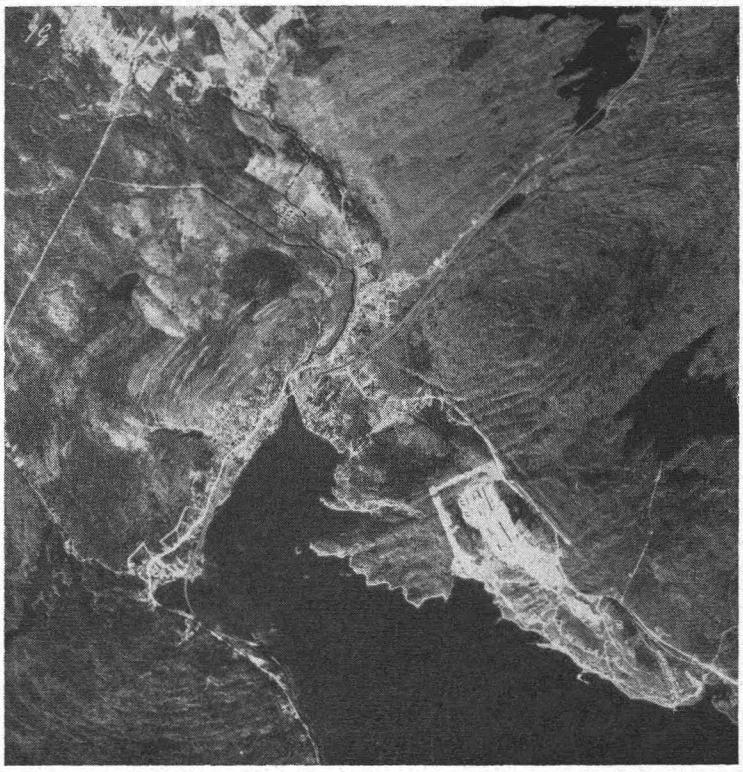

FIG. 5. Bedford syncline, Halifax Co., N. S. (Photographic Survey Photo).

FIG. 6. Dunbegan syncline (Photographic Survey Photo).

forest, but it remains as a potential new area of arable land, if the farming industry of the Province expands.

Cape Breton offers some controversial problems to the glaciologist. The anomalous direction of ice movements in the southeast, with their terminal moraines and associated drumlin areas, are awaiting further study. The question of the glaciation of the northern plateau would appear to be settled in favour of glaciation. Figure 2 will probably settle the argument for the geologists. It appears to be a typical glaciated surface. Figure 3 shows a drained glacial lake formed by the usual outlet damming and overflow into a new channel. It is a potential gold dredge location, as gold can be panned from any of the slip-off slope sandbars of the Margaree River in this valley.

STRUCTURAL GEOLOGY OF NOVA SCOTIA

Figure 4 is a reduction of an unpublished geologic and tectonic map of Nova Scotia compiled from all available resources. All data have been checked by air-photo interpretation and some interesting statistics have been obtained. Approximately 60 per cent of all fold structures mapped by ground methods show clearly and could be mapped from the air photos. Of the remaining 40 per cent, 25 per cent occur either in Pre-Cambrian or other metamorphosed rocks which show only as highland remnants. The soft Mississippian rocks are often contorted locally, or only evidence of solubles, such as limestone or gypsum appears.

About 15 per cent are obscured, mainly by glacial material, but even then, the trend of the structure often shows through the drift.

About 10 per cent of the structures shown were discovered during the photo interpretation. The majority of them are faults, but one laccolith was discovered near Cape George. One notable field of progress has been the study of igneous rocks in the southern mainland. Evidence of post-granite faulting, and granitization, have been found in the photos, and later ground checked.

The Meguma Series, which occupies half the southeast and southwest mainland has some classic examples of folding. Figure 5 shows a canoe fold at Bedford, just north of Halifax.

Figure 6 shows a syncline in Pennsylvanian rocks. This is an original from air-photos.

The main value of this work lies in the complete assembly of geological data, which offers many suggestions for further research and prospecting. It is certainly not overstating the case to say that without the air-photo interpretation, doing this work would have required twice the amount of time, and the work would certainly not be as complete.

In conclusion, these examples were chosen because they offer unit treatment, i.e., an entire Province, and they cover slightly unusual fields.

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