DISCUSSION: QUATERNARY GEOMORPHOLOGY

Moderator: J. G. Fyles

During each symposium the organisers have attempted to provide an open forum for views on the state of geomorphology with particular reference to Canada. The committee was honoured that Dr. J. G. Fyles of the Geology Survey of Canada was able to act as moderator for the discussion of the 2nd Guelph Symposium on Geomorphology. The condensed form of the discussion below represents the editor’s summary of the discussion based on the tape-recording of the session.

Dr. Fyles:

We have heard papers dealing with glacial deposits in the broadest sense. We have also heard papers dealing with frozen ground and these topics together, I think, are the principle elements in the geomorphology of Canada. Both elements are facing us as a major study and I feel that the designers of this symposium have chosen well in focusing on these things. The requirements for such study are exceedingly broad as indicated by the papers which have ranged from experimental investigation on patterned ground through analysis of the thermal regime in the active layer to the varied approaches in the study of glacial and glacial-fluvial deposits which are possible by the application of a variety of quantitative techniques.

I am afraid I do not understand fully the quantification which has developed in our studies over the past few years. Yet mystified or not I am convinced this quantification is fundamentally important if geomorphology is to be a valuable and useful force in the management of the surface of the earth. It is obvious from the discussions we have had today that there are growing pains in the development and application of new techniques. There will be many additional fields of knowledge developed as the people gain familiarity with them. Perhaps we shall sometimes be able to deal with them in the cavalier way in which we have looked at landforms and the materials and processes in the past decades. An interesting thought to me at least in this context is “What is geomorphology at this stage?” We borrow techniques from mathematicians, from chemists and soil mechanics experts and specialists in heat flow. We borrow techniques from hydrologists and all these are brought into the solution of geomorphological problems to form in part a geomorphological point of view. Perhaps even more important questions are, “What are the boundaries and the direction of geomorphology?” and “How should we communicate the consequences of geomorphological investigations and thought to the potential users of our conclusions?”

We are looking at the properties of the materials that form the surface of the earth, the actual form itself, and the processes that are taking place in changing the surface of the earth. I feel that geomorphologists in Canada are
now facing a unique challenge to communicate with others because of the tremendous increase in concern with environmental matters, the use of land and the prevention of pollution. All these things have a geomorphological core which relates to the materials at and near the surface of the earth and the processes acting there. If we geomorphologists can communicate our point of view and our conclusions to the users of such information, we will be in a very preferred position indeed. Unfortunately we as geomorphologists do not have a standard clientele. The role of the engineer is well-known; the role of the pedologist is well-known; a geologist in mineral resources has his role well-defined. Even the ecologist is being recognized as somebody who speaks loudly and clearly on a particular topic. The position of a geomorphologist differs depending on the situation in which he finds himself, and, in many fields of endeavour people feel that geomorphology is talking to itself.

We have a very real challenge here, a challenge which I find very acute in the Government of Canada today. The Geological Survey of Canada is constantly bombarded with questions about pipelines in the Mackenzie Valley, land-use regulations in the Northwest Territories, a spate of landslides in eastern Canada, dwindling of the mineral economy in Northern Ontario, and plans for major hydro-electric development in the James Bay lowland to name only a few. All of these are immense challenges for geomorphology, if we can pick them up. I feel that we must take up these challenges if the administration, management and development of the surface resources of Canada is to go ahead the way it should.

I trust that in the process of trying to apply our knowledge to these various problems we can use the kind of quantitative techniques which have been developed, and use them effectively, and communicate them in a way that they are understood and used by the planners, engineers, etc., who will have an influence on the use of our land in the coming years.

The recent landslides in Eastern Canada brought home, only too clearly, that despite some decades of investigation of the mechanisms and materials we are still completely unable to predict where a slide may take place. We cannot make a positive suggestion on how to control it or to prevent additional slides in a nearby site. We find that, despite extensive investigation of permafrost and the related landforms, the level of knowledge available to those who are planning for pipeline development in the north is exceedingly low. The Government of Canada is unprepared to undertake a knowledgeable assessment of the situation. Despite the fact that for years we have been saying that glacial drift gives us a useful means of mineral prospecting and geochemists have been saying that they can collect samples and come up with meaningful ways to discover mineral deposits, a careful look at the situation reveals that many things remain unknown, and the record is not very successful.
We certainly must focus on some of these problems and make our purpose that much more meaningful. I would like Bill Shilts to summarise a project which we asked him to do a year ago because we felt that the relationship of knowledge about glacial deposits to bedrock dispersion and geochemistry and its application to the search for mineral deposits was not very well known. We have some results which I hope show you there are a lot of things still to be done.

Editor's Note:
Dr. Shilts then gave a brief paper as an example of applied geomorphology. The paper dealt with the relationship of glacial deposits to bedrock dispersion and geochemistry, and the application of this relationship to the search for mineral deposits.

In presenting his paper Dr. Shilts stated that there were three main points which he wished to stress: (1) Scientists should be addressing themselves to the practical applications of studies of glacial deposits, (2) Studies of drift geochemistry can have pitfalls when undertaken by "the more-or-less uninitiated", (3) In future there will be a preference for research in drift deposits because of the potential applications in prospecting in the large areas covered by glacial deposits.

The study was concerned with trace elements in the glacial deposits of an area to the south-east of the Keewatin Ice Divide. The region was chosen because the history of glacial movement was well-known and the bedrock had been surveyed in detail. Samples of the drift deposits were sieved and analysed for trace elements. The deposits were considered to be either till or re-worked till. As the results were compiled it appeared that the clay-rich deposits showed higher values for trace elements.

Further examination revealed a strong relationship between the concentration of several trace elements and the percentage of clay in the sediment. Concentrations of zinc, copper and lead are directly related to the percentage of clay in the silt-and-clay portion of each sample. Zirconium appears to have an inverse relationship to the clay content. The distribution of the elements being studied seems to indicate a north south pattern. The expected S.E. flow from the ice divide is not obvious. The explanation for this is that the main Wisconsin ice movement was from north to south. The local movement away from the ice divide was only a minor pattern which produced the lineation of surface features at the conclusion of the Wisconsin.

The presentation by Dr. Shilts included data from several sections in the drift deposits and the problem of sampling by auger was underlined by reference to multi-layer sites where augering at a specified depth could have produced samples of any of the several layers. Relationships between ore bodies and the trends of trace elements were also discussed and the heavy mineral data were compared with the trace element information. Dr. Shilts concluded by emphasizing the importance of a full understanding of data for applications in prospecting. There is much information still to be derived from the data already collected in the study of drift deposits.
Following this presentation, Dr. Fyles acted as chairman for an open dis-
cussion. **Brookes (York)** asked Dr. Fyles to provide some information con-
cerning the activities of GSC in organizing a central data bank, to facilitate
an exchange of data among geomorphologists in Canada. Dr. Fyles replied
that while GSC has a data filing system, it has, so far, been ineffective in
dealing with certain problems. They are presently operating on a "part-way
basis" until an alternative method is found. **Lewis (CCIW)** commented that
the problem with such data file systems is the difficulty encountered in
entering your own data in a form which is useful to you, but at the same
time useful to others. He noted that this would encourage a standardization
in reporting data.

**Sutterlin (UWO)** added that there is a national sub-committee on computer
applications in the geological sciences. This committee is examining prob-
lems such as those pointed out above.

It was pointed out by Dr. Fyles that industry and government agencies, as
well as academic institutions, are interested in having access to data con-
cerning unconsolidated landforms and land-use, through a data file system.
The problem again is how to input this information to everyone’s satis-
faction.

The theme of outside interest in geomorphological investigations was
expanded by **Corte (Argentina)**. He presented an example of civil engineers
showing an interest in freeze-thaw studies, to aid them in constructing pipe-
lines across a land surface undergoing this cycle.

**Bird (McGill)** turned the discussion back to Dr. Fyles’ summary remarks in
regard to the failure of geomorphologists to answer important questions. He
put forward the hypothesis that it is the politician who is at fault for asking
the wrong questions in the first place. He calls for an education of “not only
the geomorphologists who are involved in this, but of the people who ask the
questions.” Dr. Fyles concurred with these remarks, and cited examples
from his own experience.

**Andrews (Colorado)** decried the fact that, in dealing with practical applica-
tions of geomorphology, we are always forced to operate on an “ad hoc”
basis. We are consulted only after the decision (e.g. to build a pipeline), has
been made.

A further example of this request for an “instant decision” was provided by
**Packer (UWO)**, and dealt with the decision by London City Council to build
a bridge. Only after the site of the construction, and the date for its com-
pletion had been decided, were the geomorphologist/geologists consulted.

**Packer (UWO)** also referred back to the remarks made earlier concerning the
need for geomorphologists to sell themselves to the potential users of their
investigations. He pointed out that an organisation called the “Institute of
Ontario Geomorphologists” was already examining this problem closely.
Dreimanis (UWO) commended the report which Dr. Shilts had presented, and called for more emphasis on such basic research.

Harris (Calgary) called for a change in the education of Canadian graduate students in geomorphology. He felt that the emphasis should be directed toward "problem solving," and away from the traditional types of research.

Dr. Fyles concluded the discussion with the comment that, while not trained in a "problem oriented" system, geomorphologists have shown the ability to apply their knowledge to practical problems. They have also shown a facility for relating well to people in allied fields, due to the broad spectrum of subjects studied by these students of geomorphology.
RESEARCH METHODS IN PLEISTOCENE GEOMORPHOLOGY

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