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Interdisciplinary Till Symposium

R. F. Legget

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Allen presented a paper by V. F. Holister, J. M. Allen, S. A. Anzalone, and R. H. Seraphim on the Highland Valley deposit - one of the giants, and gradually becoming a classic case history. A number of other papers provided a cross section of ore-pluton associations in the Canadian Cordillera, and reviewed mineral deposits of pneumatolytic origin, alkaline rocks, and geochemical studies of plutonic bodies.

Any erroneous impression that the problems had all been solved was effectively and humorously put to rest by D. Strong in his off-the-cuff "with a few slides I just happened to have in my briefcase" postmortem of the two days of talks. Well aimed blows were struck at classification schemes, anthropomorphic descriptions of processes, and the perversity of natural systems . . "you can't really trust nature". He pointed out that nearly all the papers avoided speculation on source or genesis of plutonic rocks, perhaps for good reason. The granite controversy of past decades may not be dead but its metamorphosis has been radical - the impact of plate tectonic ideas, experimental petrology, geochemistry, quantitative structural geology, and vastly improved maps and descriptive information has dispelled many problems and recast the statement of others.

These symposia are among the least structured, and simply run, yet among the largest geologic meetings in North America. In spite of the minimum of frills - no business meetings, no field trips, no commercial displays, no ladies activities - and perhaps because of the focus - no concurrent sessions, and two days maximum length - they continue to attract a large and devoted audience. The attendance remained full to the very end.

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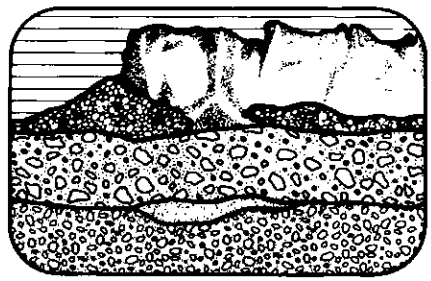

Interdisciplinary Till Symposium

R. F. Legget
531 Echo Drive
Ottawa, Ontario K1S 1N7

The uses of Till in engineering and mineral prospecting, and its significance in top-soil formation, were reviewed against an appropriate geological background at an interdisciplinary symposium held in Ottawa, Canada, on February 17 and 18, 1975. Sponsored by the Royal Society of Canada and the Canadian Geoscience Council, as well as by the individual member organizations of this Council, the meeting attracted about 260 participants for two days of review and discussion.

Four invited keynote papers set the scene for more detailed papers which were presented, in summary, and discussed in the other three half-day sessions. These eighteen papers were selected from more than 60 proposals for papers received by the organizing committee, a number that is mentioned to indicate the widespread interest in this major glacial deposit in North America and elsewhere.

Since almost all of Canada has been glaciated, it has probably the greatest extent of glacial soils of any country. It was appropriate, therefore, for the symposium to start with a general review of the geological origin and the properties of Tills. This was presented by Professor Aleksis Dreimanis of the University of Western Ontario who reviewed the dependence of all Tills upon the processes by which they were deposited, their pre-depositional erosive histories and the modes of transport that led to their present location.

In a broad-ranging review, Professor Dreimanis suggested desirable recognition of three major genetic classes - ablation till, with two varieties; basal till, with at least three varieties; and waterlaid till, even though some workers regard such material as a true sediment. Dr. John S. Scott then summarized some of the recent field studies by the Geological Survey of Canada, suggesting regional syntheses which demonstrated the great amount of work still to be done in developing accurate correlations. He pointed out that about three-quarters of Canadian surficial deposits are Till; surface soil maps are therefore useful aids in till studies.

Dr. Raimo Kujansuu of the Geological Survey of Finland described corresponding field investigations of his Survey, now in progress over an area of 100,000 square kilometers, close to 70°N. Special attention is being given to determination of ice-flow directions, five different directions having been observed in one location. It is clear that Finland and Canada share many of the complexities of Till. One special Canadian phenomenon described in another paper was the formation of thrust-moraine ridges as surface evidence of glacial thrusting, the 'stacks' so formed often containing bedrock as well as Till.

Three more detailed geological papers presented results of the applications of methods now used for stratigraphic correlation of Tills in central and western Canada and an analysis of the variability of till composition aided by statistical methods. Professor Paul Karrow of the University of Waterloo reviewed such methods in general and the significance of their recent development, suggesting that wider use of such detailed investigations can be anticipated. In discussion, the continuing importance of detailed field studies was likewise stressed, both approaches being clearly desirable in the future with proper inter-relation.

Professor R. J. St. Arnaud of the University of Saskatchewan (and currently President of the Canadian Soil Science Society) presented the main review of the pedological aspects of Till. From a wide variety of sources he discussed the influence of till type on the formation of soils developed from them and their relationship, in turn, to soil fertility and other land use considerations. He described the main soil types of Canada but used as more specific illustrations the soils of western

Canada. Of special interest was a map he exhibited showing a steady decrease in the carbonate content of surface soils as one travels westwards across the Canadian prairies.

A more detailed discussion of the carbonate content of Tills in Saskatchewan and its influence of soil formation was presented in a further paper. Three different Tills found in Quebec were similarly discussed and the soil profiles developed from them were compared, with attention to the use of these soils in agriculture and forestry. Three quarters of the forested area of British Columbia is underlain by Till; a detailed study of six Tills in the Sayward Forest was reported upon with an indication of some correlation between depths of weathering, and clay content, with the height of trees.

In his introductory review of the geotechnical aspects of Till, Victor Milligan, a principal of H. Q. Golder and Associates, consultants of Mississauga, Ontario, necessarily had to limit himself to a few selected topics, so important have the properties of Till become in all Canadian geotechnical/engineering work. Selected examples from his wide experience enabled Mr. Milligan to demonstrate the wide variation in till properties that may be encountered on the same building site, variations pointing to the necessity for the best possible prior information on the glacial history of the tills in question. Wide variations, similarly, in piezometric pressures encountered in tills pointed to the need for recognition and study of "paleotills" (as urged by Prof. G. W. White).

Detailed studies of till properties were reported from Quebec and south-western Ontario. From western Canada came a review of the fractures found there in Tills, examples being given also from North Dakota. Movements of water through these fractures is being studied as is the composition of the water found in these widespread till features.

Experience in the handling of tills on construction jobs came in papers on the Tills encountered on the water power developments now under way on the Nelson River in Manitoba, and on the use of 200,000 cubic yards of Till for the construction of a dam, under winter conditions, on the Unknown River of Central Labrador. The last paper of the conference discussed the unusual properties of loose glacial tills encountered in Labrador. Essentially non-cohesive, they can cause serious construction problems in the presence of water. Their mode and areal extent are being studied.

The fourth major area of the symposium was the detailed study of Till as a relatively new technique in mineral exploration. Dr. W. W. Shilts, of the Geological Survey of Canada, in his introductory invited paper, gave a brief history of this significant development and discussed the factors that affect apparent patterns of dispersal of till components. From his own experience, he gave examples of the potential that this new study of Tills presents for all glaciated areas.

Detailed studies of Till with mineral exploration in view were given from Quebec and Newfoundland. In a selected area near Rouyn and Val D'or in northwestern Quebec, over 7,000 samples (taken at quarter mile intervals) have been studied, leading to over 300,000 items of information that must be statistically assessed. A similar local study as been carried out in the Sheffield Lake area of north-central Newfoundland, as a result of which a target area has been delineated for more detailed study by test drilling.

Discussion of these significant developments, as of all the papers presented, was facilitated by the planning of the Organizing Committee which set aside twenty-five per cent of the total meeting time for open discussion. Even this did not prove to be enough, the time given by the absence (due to illness) of one speaker also being fully used for discussion as well as extra time at the end of two sessions. The dominant impression was that the importance of Till is now fully recognized, certainly in Canada, its consideration in these practical ways being necessarily and essentially linked with basic geological studies.

The Symposium was a direct outcome of an earlier meeting, also sponsored by the Royal Society, held in Kingston, Ontario in 1960. *Soils In Canada* was the volume that resulted from that meeting, copies being still available from the University of Toronto Press. It is hoped that the proceedings of the Till symposium will be published in similar format; public announcement will be made when the volume is ready.

The Ottawa meeting was also closely linked with the symposium on Till held at Ohio State University in May, 1969, under the chairmanship of Professor Richard P. Goldthwaite who was a welcome participant in the Ottawa meeting. The geological aspects of Till were fully considered at the Ohio meeting so that the two Symposia were complementary. *Till* is the title of the Ohio volume, copies of which are still available from the Ohio State University Press. The stimulus provided by these two meetings should prove of real benefit to further active research progress in the study of this widespread result of glacial action, so widely known as Till.

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