

van der Meer, J. J. M., editor (1987): *Tills and Glaciotectonics*. A. A. Balkema, Rotterdam, viii + 270 p., 17.5 x 25.5, 45,00 \$US.

David R. Sharpe

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The section on Till contains 12 papers varying from regional reviews (Rappol, Stephan), local genetic interpretations (e.g. Ehlers *et al.*, Whiteman), outcrop interpretation (Dreimanis *et al.*) or single attributes of till (Glass and Killey-clay minerals; and, Zandstra-erratics). The till section could have been a little better organized by grouping all of the European papers in order, as several papers related to Saalian features and sediments in northern Germany and The Netherlands. There is increasing interest in the structural attributes of till particularly with focus on the possible role of deformable sediments. Thus, of note were several papers that identified key structures in diamictons which bear on types of deformation (Dreimanis *et al.*, Warren and Rappol). The section on glaciotectonics contains 7 papers which deal with Pleistocene examples (Ber, Dredge and Grant, van der Wateren, van Gijssel) and one from a modern setting. Two miscellaneous papers and a field trip review rounded out the volume.

The most interesting aspect of this volume is the integration of structural geology into the interpretation of Quaternary sediments and landforms. The papers by van Gijssel and van der Wateren, Dreimanis *et al.*, and Dredge and Grant are particularly good cases. For example, van der Wateren (and van Gijssel) presents detailed structural data to support the model of thin-skinned overthrust motion to explain the formation of so-called «push moraines». Detailed sedimentological logging helped define complex structural relationships related to the stresses required to produce extensive thin nappe structures in unconsolidated sediments. Detailed sketches also helped to portray the significant relationships presented in several of the papers.

Another interesting aspect of the volume is the group of papers (Stephan, Kabel-Windloff, van Gijssel, van der Wateren, Meyer, de Gans *et al.*, and van den Berg) on the area of northern Germany and The Netherlands particularly the push moraine ridges of the Rehburger, Falkenberg, Neuenkirchener, Altenwalder and Falkenberg end moraines. These moraines have a complex structure of stratified sediment and diamicton. The ridges apparently have a topographic association because eroded basins and tunnel valleys are spatially associated with them. The volume of sediment eroded from the basins equals the volume in the pushed ridges and differential hydrostatic pressure (confined by lacustrine and Tertiary clays below) and subglacial tunnels were important in the origin of the moraines. Tertiary and Mesozoic clays also provided a surface for decollement for the thrust belts. The ridges commonly have a fringe of outwash fan sediments and other interbedded glacialfluvial material. This geo-

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This book is a volume of proceedings of an INQUA symposium on genesis and lithology of glacial deposits held in Amsterdam in the fall 1986. The intent of the meeting was to focus attention on glaciogenic sediments in northwest European basins primarily reflecting work in The Netherlands and northwest Germany. Fifty participants from 13 countries attended and this volume contains 22 of the 26 papers presented.

As is usual with such INQUA meetings, the presentations represent a mixed collection with papers from North America (4), Britain (3), Scandinavia (1) and Antarctica (1) besides the host region of northwest Europe (13).

morphic setting and significant subglacial water source helped induce glacial thrusting during ice marginal fluctuation (possibly during surge conditions?). This general setting is illustrated in the paper by van den Berg, a paper that should have been placed at the beginning of a series of papers from the area on the ice thrust ridges.

The paper by Dreimanis *et al.* displays the best example of the need for, and the use of, multiple criteria for interpretation of complex glacial sediments by using structural, fabric, lithologic and sedimentological data. Some papers relied too heavily on single aspects such as fabric or petrology. Others concentrated on classic stratigraphic methods without integrating landform information that would allow comparison with other areas. Several papers used schematic illustrations of a model such as morainal thrusting (paper by Meyer) but provided no clear data to support the model. In one instance, (Rappol) alludes to some interesting aspects of subglacial tectonics but his summary sketches are not identified from particular outcrops or discussed in enough detail to assess their general importance. In another example (Schluchter *et al.*), till facies are described in detail and then quickly forgotten as discussion centred on a «final lodgement phase». This phase was concluded to relate to «drumlinization» but there was no prior mention of drumlins or this overall aspect of the study. One paper (Kabel-Windloff) had no location map and no photographs but had interpretations that were far too complex. These types of editorial oversights should have been corrected during review.

There were other minor editorial slip-ups such as an inverted photograph and several spelling mistakes. Photographs could have been larger and reproduced better in most papers. In general the volume is well put together despite the fact that English is not the mother tongue of the editor or many of the authors. The typeface is legible and the numerous clear line-diagrams are well displayed.

In summary this book is recommended for anyone interested in the application of structural observations to the analysis of Quaternary sediments and landforms, and in moraine formation in northern Europe. The book will provide a good introduction to a companion volume by Balkema: *Glaciotectonics: forms and processes*.

David R. SHARPE  
Geological Survey of Canada