

## 6. A Plan for the Conservation of the Quaternary Geological Phenomena in the County of Hedmark (Norway)

By LARS ERIKSTAD\*)

### 6.1. Introduction

In Norway, a national programme for the registration and protection of various natural features has resulted in the recognition of about 900 areas worthy of conservation during the past 15 years (ERIKSTAD & HARDENG, 1988). Within the field of Earth-sciences, Quaternary geology is given priority and a registration programme, based mainly on geomorphological criteria, will be completed this year. This will result in a conservation programme whose aim will be to protect localities and areas of national importance all over the country using the powers of the Nature Conservation Act (ERIKSTAD, 1984). The general management of sand and gravel extraction, however, is controlled by the Planning and Building Act, but this makes inadequate provision for conservation. As a means of improving this situation, a national registration programme for sand and gravel resources is being conducted by the Norwegian Geological Survey (NEEB, 1987).

### 6.2. The Hedmark Project

The Quaternary geology of Hedmark is dominated by the county's location on both sides of the culmination zone of the Scandinavian Ice Sheet. The ice divide lay to the south of the watershed and the county offers classical localities for ice-dammed lakes and ice-directed drainage patterns (SOLLID & REITE, 1983). In Hedmark is proved possible to establish co-operation between the nature conservation authorities, the mapping authorities, and the road authorities in the county and the Hedmark Project thus included mapping on the scale of 1 : 250,000 together with the preparation of a popular description of the quaternary geology of Hedmark (SOLLID & KRISTIENSEN, 1983), mapping of the sand and gravel resources on the same scale (SOLLID & KRISTIENSEN, 1981), and the registration of sites of nature conservation value (SOLLID & KRISTIENSEN, 1982). This co-operation was extremely important as it minimised conflict between the road and nature conservation authorities when it came to putting forward concrete suggestions for protected areas. It was also important in establishing a realistic view of the economic implications of the suggested protected areas, especially as Hedmark is one of the most recent counties in Norway to register its sand and gravel resources (NEEB, 1987).

### 6.3. The Conservation Plan

Following the registration of 71 candidate areas, the Fylkesmannen i Hedmark (1984) selected 33 areas to

be covered by the Conservation Plan. The selection was governed by a wish to make the coverage of the Conservation Plan representative in respect of those Quaternary landforms which are found in the county. Furthermore, it was intended that the areas selected for inclusion should contain continuous systems of landforms so that the Quaternary systems could be documented as thoroughly as possible within the protected area. Each of the different stages of the late glacial period in Hedmark would be represented, and each of the chosen landforms would be clear and instructive. Possible other conservation values, landscape values and educational values were then taken into account.

### 6.4. Sand and Gravel Resources

Sand and gravel resources in Hedmark are concentrated in the valley floors and along the paths of the ice-directed drainage patterns. In most parts of the county their quality is poor to medium but, in the south, the quality is good. Generally there is a surplus of sand and gravel in the county, but in the southern parts this is not the case. As most of the areas proposed for conservation are concentrated in the central and northern parts of the county, this should imply that the costs in establishing the protected areas will be fairly moderate.

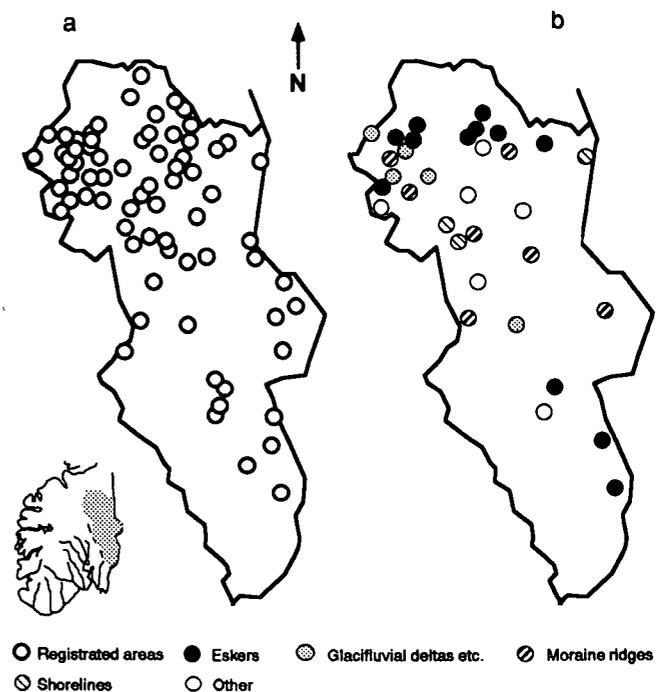


Fig. 7.

a) Registered localities of regional and national importance.

b) Areas suggested as protected areas in the conservation plan, indicating the dominating features.

\*) Author's address: Dr. LARS ERIKSTAD, Norwegian Institute for Nature Research, University of Oslo, P.O. Box 1037 Blindern, N-0315 Oslo 3, Norway.

## 6.5. Conservation Rules

Compensation for the loss of income from sand and gravel extraction will, however, be only a part of the total costs incurred when these nature reserves and landscape protected areas have been established. Forestry is important in Hedmark and, although great emphasis has been laid on not proposing more restrictions for the conserved areas than necessary, it has proved difficult to draw up rules which give enough protection without having some effect on commercial forestry.

This at once raises the problem of whether or not it is sound conservation policy to draw up regulations specially tailored for the particular needs of each area to be conserved, rather than to adopt fundamentally standard rules which apply to all nature reserves whatever their interest. Current thinking in Norway has moved towards the former viewpoint and this implies, as in the case of the Hedmark Conservation Plan, that the regulations to be introduced will restrict all activities likely to damage landforms and geological structures, but will not in principle restrict activities affecting the rest of the ecosystem. When such a policy is adopted, it is important carefully to examine exactly what it is intended conservation should achieve within the protected areas so that purely economic reasons do not govern the establishment and the management of each nature reserve.

## 6.6. Conservation Policy and Practice

Since 1984, the Conservation Plan has gone through an extensive political and administrative process, both locally and with national authorities and organizations. Although this has resulted in a plan approved in principle, ready for the establishment of reserves and landscape protected areas, progress has now been halted through changed economic considerations. The main problem arises from new legislation for compensation (made in 1985) which has now greatly increased the costs of establishing nature reserves. This, together

with the overriding priority given to pollution control and the use of the new Planning and Building Act in nature management, has left the more classical forms of nature conservation somewhat behind.

This, hopefully, is only a delay and not an end to the work on the conservation of the key areas for Norwegian Quaternary geology. The government has recently stated that conservation of such areas and localities should continue through the operation of both the Nature Conservation Act and the Planning and Building Act. In addition to this, proposals for a new Sand and Gravel Extraction Act have been prepared and such an Act will be important and useful in the field of Earth-science conservation.

By a Royal Decree of 22<sup>nd</sup> December 1989, 22 nature reserves and one landscape protected area were established as a result of the Hedmark Plan. Most of the areas excluded from the Plan were mountain areas with a low level of land-use conflict and their conservation interests are to be guarded by means of the Planning and Building Act.

## References

- ERIKSTAD, L.: Registration and conservation of sites and areas with geological significance in Norway. – *N. geogr. Tidsskr.* **38**, 199–204, 1984.
- ERIKSTAD, L. & HARDENG, G.: Naturvernområder i Norge. – Ministry of Environment, Report T-713, 147 pp., 1988.
- FYLKESMANNEN: I Hedmark: Utkast til verneplan for kvartaergeologiske forekomster i Hedmark fylke. – 100 pp., 1984.
- NEEB, P.-R.: Årsmelding for Grus- og Pukkregisteret 1987. – NGU Report 88.061, 1987.
- SOLLID, J. L. & KRISTIANSEN, K.: Hedmark fylke. Sand- og grusforekomster. – Report, Department of Geography, Univ. of Oslo, 22 pp., 1981.
- SOLLID, J. L. & KRISTIANSEN, K.: Hedmark fylke kvartaergeologisk verneverdige områder. – Report, Department of Geography, Univ. of Oslo, 87 pp., 1982.
- SOLLID, J. L. & KRISTIANSEN, K.: Hedmark fylke. Kvartaergeologi og geomorfologi. Beskrivelse til kart 1 : 250,000. – Ministry of Environment. Report T-543, 101 pp., 1983.
- SOLLID, J. L. & REITE, A. J.: The last glaciation of Central Norway: In: EHLERS, J. (ed.): *Glacial deposits in north-west Europe*, 41–59, Rotterdam (Balkema) 1983.

## 7. Glacial and Glaciofluvial Landscape Types of Finland and Practical Problems of their Utilisation

By OSMO KONTTURI\*)

### 7.1. The Genesis of Glaciofluvial Landscapes

The glaciofluvial landscapes in Finland originated and developed as the result of a combination of geological (IGNATIUS, etc., 1980), biological and socio-economic processes over the last 12,000 years.

\*) Author's address: Dr. OSMO KONTTURI, Karelian Institute, University of Joensuu, Unit of Applied Geography, P.O.B. 111, SF-80101 Joensuu, Finland.

Glaciofluvial deposits, i. e. gravel and sand areas, are very suitable for many purposes. They consist of material important for its use as aggregate and form rich stores of ground water supplies. Glaciofluvial areas are also good building bases for roads and railways – many towns and other centres are situated on them. On the other hand, glaciofluvial landscapes are unique natural formations even on a worldwide scale and thus are important for nature conservation. Because of their variable terrain, pleasant forests and lakes, they are very suitable for recreation. Thus glaciofluvial areas