NORSAR

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SEMIANNUAL TECHNICAL SUMMARY

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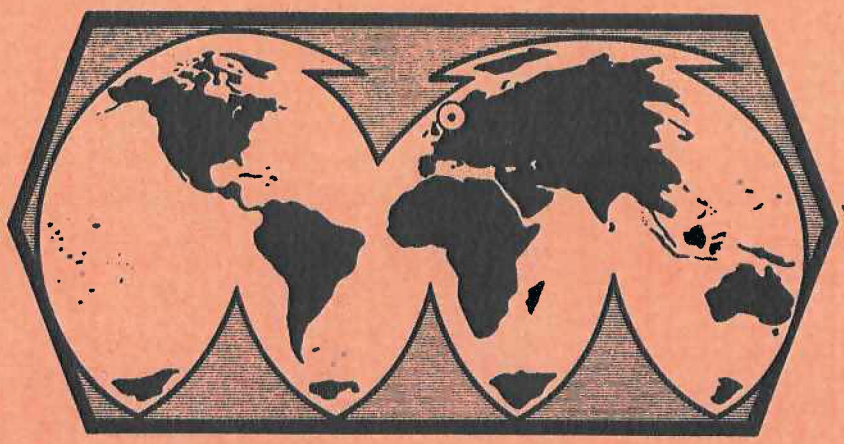

VI.3 A Digital Microearthquake Network in Southern Norway

Two major trends in earthquake seismology have been evident over the last few years. The first one is a change of interest from interplate to both inter- and intraplate earthquakes, and the other is an increased interest in microearthquake studies, often triggered by the need for more reliable information about seismic risk for industrial installations such as large dams and nuclear power plants. Scandinavia is no exception in this respect, as the above two points are covered by projects which will result in considerable improvements with respect to the deployment of seismic stations in the area (see also Section VI.1). The conventional seismic stations and the array stations (NORSAR, Hagfors) which have been operated so far have all been directed primarily towards teleseismic events, leaving much to be desired as far as the local seismicity is concerned. This situation will now be greatly improved with the installation of 27 new microearthquake stations, organized in a Swedish/Danish and a Norwegian project (see Fig. VI.3.1).

Seventeen Swedish and the 3 Danish stations are expected to be in full operation this year, with a central processing center in Stockholm operated by the Swedish Defense Research Establishment (also responsible for the Hagfors array). The data will pass a real-time detection system and selected time intervals will be recorded with a dynamic range of 140 dB (gain-ranging amplifiers) and a sampling rate of 60 Hz. The project is planned for a 3-year period.

The Norwegian project is a joint undertaking between NTNF/NORSAR and the Norwegian Water Resources and Electricity Board (NVE), and it is not expected to be in operation until the first half of 1980. There are 7 stations as shown in Fig. VI.3.1, one of which (the westernmost) is a three-component station to be located very near a large dam (Blåsjø). The seismometers will be Geotech S-13, the data will be passed through two amplifiers (one high-gain and one low-gain) simultaneously in order to increase dynamic range, and then transmitted in analog form to our data center at Kjeller. A minicomputer will there digitize and analyze the

data in real time, and selected time intervals will be recorded and stored on digital 9-track (800 bpi) magnetic tape for later offline analysis. The planned operational period for the Norwegian project is also 3 years, with a total cost estimate of 1.9 million N.kr., to be covered jointly by NVE and NTNF. There will be options for continuing the surveillance at Blåsjø beyond the 3-year period.

It is evident from these plans that we are now facing a unique possibility to study the southern Scandinavian seismicity (where earthquakes with m_b=6.0-6.5 have occurred) with a much greater accuracy than before (location accuracy 1-5 km, detection threshold near to m_b=1.0). Furthermore, this network of 27 high-quality stations (large dynamic range and high sampling rate) will also provide great possibilities for research within regional detection and discrimination and to some extent also for studying teleseismic events. The greatest problem expected for the data analysis is that more than 90% of the recorded local events will be man-made explosions.

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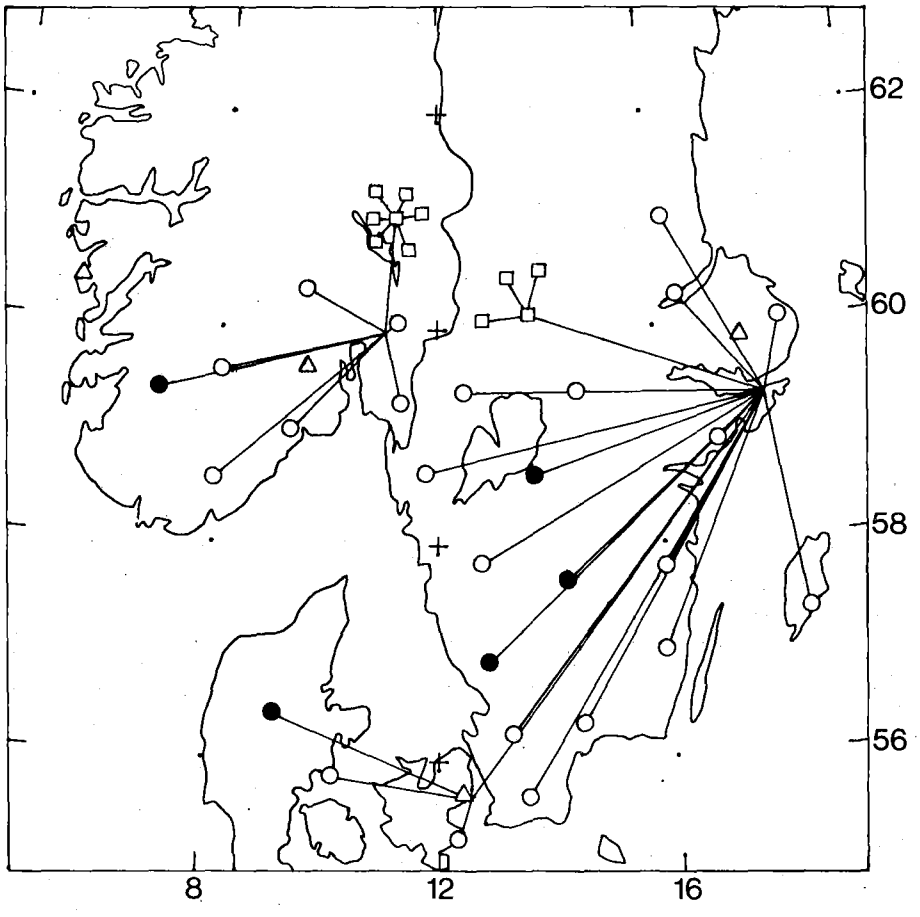

Fig. VI. 3.1 Map showing existing conventional seismic stations (triangles), array stations (squares) and planned microearthquake stations (circles, solid for three-component) in Scandinavia. The 3 microearthquake stations in Denmark and the 17 in Sweden will all have data transmitted to Stockholm, while the 7 in Norway will have data transmitted to Kjeller.