

FAULT TECTONICS IN N.W. EUROPE

PREFACE

R.T.C. FROST & A.J. DIKKERS

Faults play a very important part in the geological work of the petroleum industry, especially in the development stage of oil and gas fields. Even small faults, with perhaps only a few tens of metres of throw, can have a controlling influence on the spatial distribution of reserves and, hence, on the number and arrangement of the production wells to be drilled. Unfortunately, the geometry of faulting in the subsurface is often very hard to define and experience has shown that, even with a dense seismic grid, there is often still considerable freedom for making different fault interpretations from the same basic data.

I.B. Ramberg *et al.*, in their article in this volume, say that the mapping of lineaments, interpreted as mainly fractures, "... has revealed a strikingly regular pattern in southern Norway". M.R.W. Johnson told us that a colleague, on first seeing the fault map of the Highlands (this volume), voiced his surprise at "the amount of system in the fault of Central Scotland". Obviously, if any systematic arrangement exists in the fault pattern in an area, a geologist working in that area should have the fullest possible knowledge of the system and use it to increase the verisimilitude of his fault interpretations. To this end, Koninklijke/Shell Exploratie en Productie Laboratorium (Rijswijk, The Netherlands) started a research project in late 1974 aimed at collecting information on faults and fault patterns in northwest Europe, the intention being to make this information readily available to operating personnel engaged in structural interpretation work in the North Sea region. Fortunately, several geologists, not members of Shell Group staff, were found prepared to contribute from their expert knowledge of special areas of interest. Some of the results of the project are reported in the papers in this volume.

In the North Sea region, interest is naturally concentrated on the Permian and younger formations (overlying the

Saalian Unconformity), in which the oil and gas reserves are contained. However, there existed a fairly general opinion that the tectonics of these formations were largely determined by the structure of the underlying "pre-Saalian basement". Consequently, attention was primarily directed to fracturing in the basement. In this volume, Dikkers sketches a possible pattern of regional fractures, or "lineaments". Johnson & Frost describe the fault and lineament systems in part of the Scottish Highlands and Ramberg *et al.* do the same for southern Norway, thus covering two areas framing the North Sea Basin.

In order to illustrate the effects in the overburden, two areas were selected. The Rhinegraben, probably one of the best studied of all grabens, is described by Illies. The Mesozoic Central East Greenland Basin is treated by Surlyk, and was included because it was believed to be similar to the Greater Brent oilfield area and, on plate tectonics grounds, was probably closely associated with the latter. Frost presents statistical evidence supporting the similarity between linear patterns in the basement and the overburden. Horsfield reports on scaled experiments intended to elucidate the mechanisms of basement-controlled faulting in the overburden.

From the viewpoint of practical oilfield geology the most significant conclusions would appear to be twofold. Firstly, faults generally tend to be straight; sinuous traces, on closer inspection, are often made up of straight elements with angular intersections. Secondly, within each of the areas considered, the faults can be grouped into a relatively small number of more or less clearly defined directional groups (although the patterns are not necessarily correlatable from one area to another).

The editors trust, however, that the material offered in the following papers will be of interest beyond the confines of the immediate objective of the project.

ACKNOWLEDGEMENTS

The editors wish to thank the Editing Board of "Geologie en Mijnbouw" for making this entire issue available to them.

Their thanks also go to the Management of Koninklijke/Shell Exploratie en Produktie Laboratorium for making the

project and this publication possible, and to Shell Internationale Petroleum Maatschappij B.V., The Hague, for their permission to publish these papers.

The editors would further express their sincere appreciation to all those who contributed to this publication for their enthusiastic cooperation.