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Aller au sommaire du numéro

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The Ocean Basins and Margins, Vol. 2: The North Atlantic

Edited by A. E. M. Nairn and F. G. Stehli
Plenum Press, New York - London, 598 p., 1974.
$38.00

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This is a very well produced companion volume to that concerned with the South Atlantic published in 1973. The volume has 14 chapters, of which the first is a summary introduction by Nairn and Stehli, which, despite its brevity, is most useful to a non-specialist. The paper discusses the present form and the evolution of the North Atlantic Ocean. Unconsciously, however, it illustrates the basic limitations of the volume in the sense that the North East Atlantic Ocean is not really dealt with in any comprehensive sense, insofar as the actual ocean remains undescribed and margins are considered patchily. The same patchy nature of coverage to a certain extent applies to the rest of the region: The aim of the volume as alluded to on the dust jacket is to deal "with the geology and geophysics of the North Atlantic Basin and adjoining regions from North Africa to North America," and indeed the editors by selecting many knowledgable and active authors have been largely successful in their aim to describe the margins, although there are noticeable gaps. Eastern Greenland (Chapter 5) and a part of Scandinavia (Chapter 6) are covered, but their continental shelves remain only partly discussed. On the other hand while the western approaches to the British Isles (Chapter 8) and the pre-Mesozoic setting of the British Isles (Chapter 7) are engagingly described and interestingly treated, there does not appear to be any sign of the North Sea and considering that it is the best studied marginal basin to the Atlantic Ocean its absence is surprising. On the other hand while the geology of Newfoundland (Chapter 4) is clearly described and the eastern North American continental shelf (Chapter 3) is superlatively well treated, the continental North American rocks from the Bay of St. Lawrence to Florida receive virtually no attention at all.

There are of course regional synoptic descriptions in the book that are difficult to find elsewhere and which heighten its value. For instance, the sedimentary history and sedimentation of the Bay of Biscay (Chapter 9), the Bahama-Blake Plateau region (Chapter 2), the geology of volcanic islands of west Africa (Chapter 10), of the Azores (Chapter 12) and of those in North East Atlantic (Chapter 11) are most useful. Although even here there is some imbalance, since nine pages go into the description of Iceland and 34 pages into that of the Azores.

In addition to the limited areal descriptions some general broad problems of the region as a whole are attempted. The geophysics of the North Atlantic Basin (Chapter 15), the Tectonic and radiometric age comparisions (Chapter 13) and the Recent and Cenozoic volcanism in the North Atlantic (Chapter 12) are reviewed and these I intend to discuss in some detail.

In Chapter 15 H. C. Noltimier deals fairly briefly with the highlights of geophysical investigations in the North Atlantic, although the only crustal section that he quotes is from the South Atlantic. This chapter is well written but is somewhat out of date. There are for instance only nine post-1970 references amongst some 150 quoted. In a subject which has been growing very fast, this suggests that the paper has not seen the benefit of much post-1970 literature. Throughout much of the chapter, one gets a vague impression that the author is only peripherally familiar with the topics that he discusses. Geophysically, the main topics of the chapter are the seismic studies, the magnetic anomalies and the oceanic heat flow. The first item suffers from being written for both specialists and general geologists at the same time. Thus curious digressions as on the subject of transform faults (p. 554) have a pedagogique value, but are overwritten in the context of the Atlantic Ocean. The heat flow studies are well-reviewed but again tend to digress into general theory. Lastly, the section on magnetic anomalies is out of date and were it not for the map-diagrams of the editors (p. 6) one would gain a somewhat misleading notion that the only work done in the ocean has been on the Reykjanes ridge.

In Chapter 13 F. J. Fitch *et al.* attempt a comprehensive age and tectonic comparisons throughout the North Atlantic region. This paper could also be slightly updated (pre-1971 data only), but nevertheless is of prime importance since it attempts to project dated geological structures across the ocean. The tentative final reconstruction (p. 526) that they advance is not only of general significance, but despite minor errors is a very convincing demonstration of the principles of continental (Mesozoic) drift. Anyone starting on geochronological studies in the North Atlantic Region could use this paper as a starting point.

The chapter (11) coordinated by A. Noe-Nygaard on Cenozoic and Recent volcanicity in the North Atlantic Ocean is factually good on Greenland and Iceland, but is a mere catalogue as far as the British Tertiary Hebridean province is concerned. The chapter as a whole suffers from extreme conservatism; for instance on p. 431 the authors state: "At present, no detailed discussion of the petrogenesis of basalts can be given,": and the authors certainly stick to this dictum. The British Tertiary Province is treated perfunctorily. Hard facts and connecting ideas are difficult to grasp unless one is familiar with the region as a whole. The writer - Dr. C. K. Brooks - refers to his own paper as of 1973 in the text and as of 1972 in the references. He is most cautious about making any decision whatsoever. From reading the section on the British Isles it would be difficult to come to any positive conclusion as to when did the volcanicity start. One has to refer to the paper by Fitch *et al.* in the same volume (p. 521) to find out that the volcanism "is thought to have begun at or shortly before 66 m.y." On p. 471 the author states that in Scotland Arran, Rhum, Skye and St. Kilda there are important centres of plutonic activity. The author has clearly forgotten Mull which after all is only the birthplace of modern petrology.

Of the regional chapters (2 to 11 inclusive) I would select that by M. J. Keen (Chapter 3) and by J. A. Dewey (Chapter 7) as best written, comprehensive in scope and exciting to read. Keen's paper deals with the continental margin of North America. It is written against the background of personal investigations. It is consequently well illustrated and

examines the geography, the extent, the sedimentation, the structure and the evolution of the continental shelf. The section on the ocean-continent transition is useful and very well argued. The paper was clearly and completely up to date when it went into press.

Dewey's paper on the Geology of the southern termination of the Caledonides is again well and clearly written and presents a good case for the intersecting Caledonian and Variscan orogenic belts. The paper is accurate and is based on Dewey's own experience. He has incorporated into the paper the notion of tectonic zones and elements which was first developed in a small sub-committee of the Geological Society of London of which he and I both were members. This notion he has used adroitly and ably and as a result the paper is a blue-print for further Transatlantic correlations.

The other regional papers cannot be reviewed at length, but their general quality is high and as a background volume the book can be recommended to a general reader although not in all cases to specialists. The most obvious missing feature is the absence of a description of the North Atlantic Ocean as a whole, of its extent, topography, sedimentation and structure. Thus the margins, often well-elucidated, appear as fragments arranged round a conceptual hole with a few volcanic islands in it. The other general criticism of the book is that since it is arranged in individual papers it is a pity that it had to go through the mill of normal book publication. If these papers were published in a journal they would not have been behind the all too fast moving times as they appear at present.

MS received May 20, 1975.

Tectonics of the Carpathian-Balkan Regions: Explanations to the Tectonic Map of the Carpathian-Balkan regions and their Foreland.

Edited by Michael Mahel
Geological Institute of Dionyz Stur, Bratislava, 450 p. 1974.
150 (CCSR) Koruna ($30.00).

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This book of facts complements nine 1:1,000,000 tectonic maps covering the fascinating region of the Eastern Alps, the Carpathians, the Balkan, and the Dinarides. It clearly documents the tectonic complexities and uses interesting ways to resolve them cartographically. Beyond this, the book contains detailed descriptions of the different orogenic strands and some 140 cross sections based on mapping, drilling and seismic explorations. The task of the editor, M. Mahel of Czechoslovakia, was a formidable one in that he had to incorporate tectonic concepts developed in 13 different national domains without abandoning the factual restraints imposed by the regional contributors. The data base for this work seems to be that of 1970, and western readers should be able to pursue their own special interest with the aid of numerous references scattered throughout. The work is timely as tectonic maps are being updated in adjacent regions as well, e.g., the recent 1:500,000 masterpiece covering Switzerland.

The most important concept used by Mahel and his co-workers is "time of folding", and particular emphasis is placed on the distinction between the Hercynian or older basement structures and structures created during the Alpine cycle of deformation. The breakdown of the Alpine orogeny into Paleoalpine (Cretaceous), Mesoalpine (Paleogene), and Neoalpine (Neogene) phases of deformation with outward migration of folding from an orogenic core zone to the foredeep is a useful frame of reference, particularly as it seems to hold for the Western Alps as well. The intensity of the various "pulses", however, differs markedly from segment to segment and introduces a major cartographic problem. The important concept that lithology controls the tectonic style is well recognized. Mahel replaces the usual term "tectofacies" with the word "tectonogroups" and the painful soul-searching prior to the introduction of this term must have been similar to the one that preceded the struggle for "assemblages" and "belts" in the Phanerozoic orogens of Canada. The main tectonogroups are Pre-Mesozoic, Triassic, Jura-Cretaceous, Flysch and Molasse. Although quite meaningful in a broad sense the resulting local terminology still remains the headache of Alpine geology. Time-transgression and facies variations within tectonogroups are dealt with by further subdivisions (e.g., normal flysch, sandy flysch, cryptoflysch, calcareous flysch, Krasta flysch, conglomeratic carbonate flysch, heterogeneous flysch, wildflysch). Distinct tectonogroups generally form individual thrust units or nappes emplaced over stratigraphically younger tectonogroups.

With establishment of the time of folding and lithologic tectonogroups emphasis shifts to the "significant structural features" (e.g., thrust faults, normal faults), which separate the tectonic units. The compiler thus decides if major nappes in one area can be carried along strike or if they die out. From this kind of analysis it is clear that areas of complex facies patterns result in a complex mixing of tectonogroups, whereas uniform lithologic units may display equally simple tectonic styles along trend. In the Carpathians this is clearly demonstrated by the Krizna nappe.

The authors of the regional papers give many illustrations of changes in the time of deformation and structural style along the trend of the Alpine-Carpathian chains.

Although quality of documentation varies from section to section, the introductory chapter by Mahel helps the reader to place individual sections into a regional framework. Translation and editing are of the high standard that we have come to expect from Czechoslovakian productions. The volume suffers somewhat from the absence of an index and a simplified stratigraphic chart; they would have