several respects, since Crary is without doubt the most complete geophysicist who has ever worked in the Antarctic, and his physical accomplishments are as remarkable as his scientific findings.

For the "wet-back" geographers there are many revelations about the findings in oceanography. Although the North Atlantic was the most intently studied, the most interesting findings were made in the Pacific. Geomorphologists will enjoy reading the account of the Carnegie Institution Andes Expedition, on which seismic shots at two hundred sites in the mountains of Peru, Bolivia, and Chile were set off to determine the depths of the roots of the Andes. The findings indicated that the theory of deep mountain roots had "evaporated." This was based on a reassessment by the geophysicist of the density of the earth's mantle.

"Assault on the Unknown" is extremely interesting and well written. It covers most of the studies of the IGY and is accurate in most details. It is one of the best books for geographers on the IGY, if not the best.—PAUL C. DALRYMPLE

LA VENDÉE LITTORALE: Étude de géomorphologie. By MIREILLE TERS. xix and 578 pp.; maps, diagrs., ills., bibliogr., index. Ouvrage publié avec le concours du Centre National de la Recherche Scientifique, 1961. 60 NF (obtainable from the author, 72 rue Henri Regnault, Saint-Cloud, France). 11 x 8¼ inches.

Madame Ters's geomorphological study of the western (rather than "coastal") Vendée is concerned with a section of western France south of the Loire estuary from about 46°20′ N. to 47° N. This low-lying area is dominated by an irregular terrain of granite and metamorphics, forming a cliff coast in the south, extensive coastal marshes or littoral dunes in the north. The author evidently knows the area intimately, having published on it since 1937, and here she attempts to present an exhaustive geomorphological analysis.

The first part of the book considers briefly the stratigraphy and structure of the ancient massif that dominates the region. Most of the bedrock is Precambrian gneiss and schist metamorphosed during the Variskian orogenesis. The orogeny was associated with considerable northwest–southeast folding and faulting, and with intrusive volcanism. Resistant granites of this age are now exposed at the surface in a quarter of the area.

The second part of the book treats the geomorphological evolution of the area from the Carboniferous to the present. The low Variskian mountains were immediately exposed to subaerial erosion under a tropical climate and were destroyed during the Permian. A great, flat erosional plain, probably not more than 100 meters above relative sea level, dominated the area until the early Jurassic. Its shallow drainage lines show little relation either to structure or to bedrock. This Permo-Triassic erosional plain is still preserved in the form of wide interfluves that account for a quarter of the land surface. Modern drainage is broadly determined by this ancient pattern of east–west drainage lines. Transgressions during the Jurassic deposited limestones to 75–105 meters above sea level in the southern part of the area, and Cretaceous sandstones and limestones further fossilized the Permo-Triassic erosional features to an elevation of 65–80 meters. During most of the Tertiary, subaerial erosion of the Mesozoic sediments was a dominant process, though the low relief did not permit excessive denudation. The lower Pliocene (Pontian) witnessed valley incision and slope erosion, and the upper Pliocene led to submergence of the lower valleys.

During the Pleistocene glaciations vigorous erosion and sedimentation led to the formation of two general river terraces, preserved throughout the area. The older, higher, terrace lies at relative elevations of +25–30 meters upstream but falls to +10 meters near the coast,

there suggesting gradation to a lower sea level. Ice wedges are common in this terrace. The younger, lower, terrace, at +10–12 meters, consists in large part of derived eolian materials but lacks ice wedges. Similarly of widespread areal occurrence and of Pleistocene age are mantles and lobes of solifluction materials. Younger than the solifluction beds, some of the youngest of which overlie marine beds at +2–5 meters (late last interglacial), are mantles of eolian silts of the loess class. These important deposits, dating from the maximum of the last glaciation, have smoothed the terrain and largely obscured the few preexisting surface irregularities.

Part three of the book describes the present continental relief. The drainage pattern is considered a compromise between a dendritic and a trellis type: the major tributaries join the master streams at acute angles; minor tributaries enter perpendicularly. A detailed morphometric study (hypsographic curves, mean length of valleys, mean density of thalwegs) demonstrates the homogeneity of local valley dissection. Longitudinal and transverse profile studies of the streams produce few interesting results.

Finally, part four considers the coastal morphology proper. Location of the various coastal segments is determined by the Variskian folds and faults. The two types of coastline (cliff coasts with rocky beaches, and low coasts marked by dune cordons) are discussed. Sections of fossil Tyrrhenian beaches at +25–30 meters, +10–15 meters, and +2–5 meters are described briefly, and the occasional presence of raised Holocene shorelines at +1.5 meters is indicated. Further consideration is given to the evolution of the offshore islands Yeu and Noirmoutier.

A section of general conclusions is followed by appendixes of heavy-mineral data, quartz-grain micromorphology, and grain-size spectra, and a bibliography of some 950 items.

Although the study will not attract the general reader because of its length and detail, it is an excellent treatise on geomorphological evolution, amply supported by sedimentological analyses. However, the absence of a morphological ensemble, preferably in cartographic form, is a serious lack. The morphometric approach used is not very productive, failing to improve on the lack of succinct description. The treatment of coastal geomorphology, considering the great detail devoted to topics of less geomorphic relevance, is not impressive. Despite these matters of disposition and organization, the study is a valuable regional geomorphology, done with great diligence and affection.—KARL W. BUTZER

THEORETICAL GEOMORPHOLOGY. By ADRIAN E. SCHEIDEGGER. xii and 333 pp.; maps, diagrs., indexes. Springer-Verlag, Berlin, Göttingen, Heidelberg; Prentice-Hall, Inc., Englewood Cliffs, N. J.; 1961. $13.50. 9¼ x 6 inches.

Hopefully the debate between what Bryan and Davis have called the geomorphogenist and the geomorphographer will never abate. Geographers will choose one or the other approach according to their objectives and interests. Regardless of their persuasion, however, all of them will welcome the appearance of what is essentially the first modern text dealing almost exclusively with the dynamics of geomorphic processes. As the title indicates, the approach is theoretical to the extent that most of the material deals with the principles of physics and engineering that underlie various geomorphic processes. Little or no space is devoted to descriptions of landforms or to comparative analyses of regional or climatic differences in landforms.

Introductory chapters consist of a brief description of several geomorphic environments and a brief treatment of the mechanics of flowing water, ice, and wind. Subsequent chapters