

ponent after reading this section. As Bayly carefully avoids describing the historical development of the geologic use of the phase rule, he need not be so indirect as to avoid Gibbs' Phase Rule completely. It would have been better had Gibbs' Phase Rule been introduced early in the discussion of binary systems to illustrate the meaning of "degrees of freedom" and to illustrate the restrictions on compositional variation of coexisting phases that are implied by Gibbs' phase rule.

The book is not at all concerned with a presentation of the historic contributions of men like Bowen or Eskola nor is it concerned with summarizing petrographic knowledge or regional problems, and in general it benefits from this. The book is relatively well written, but it could be much improved by removing statements like "If we see a very viscous lava, we are therefore entitled to say, 'There is a silica-rich lava'." The treatment is well balanced and impartial, and a 10-part appendix provides guides to topics such as norm calculation that would distract from the main text. Thus the book should find a place in many first courses in petrology.

LAWRENCE LUNDGREN

Studies on glaciers; by Louis Agassiz, translated and edited by Albert V. Carozzi. P. lxxi, 213, 18 pls. New York and London, 1967 (Hafner Publishing Co., \$27.50).—In the summer of 1836, Louis Agassiz, a young Swiss zoologist, visited the valley of Chamonix, the Rhone Valley, and the glaciers of the Diablerets with Jean de Charpentier to view evidence which, according to de Charpentier, proved that Alpine glaciers formerly had extended far beyond their present limits. This glacial theory, which was considered radical at the time, was being promoted principally by de Charpentier and Ignace Venetz, a Swiss engineer. De Charpentier and Venetz, however, had been anticipated in some of their thinking by Kuhn, de Saussure, Hugi, and Playfair, as well as by many Swiss mountaineers. Although originally a sceptic, Agassiz was so influenced by the convincing arguments of de Charpentier that he quickly accepted the validity of the glacial theory, greatly expanded it, and projected it far beyond the Alps. To a great extent the work of Agassiz was responsible for the final wide acceptance of the glacial theory.

Among the many lectures and publications of Agassiz on glaciation, two were especially noteworthy for their impact on the scientific world at a time when the glacial theory was still in its infancy. The first was the *Discourse of Neuchâtel*, a lecture delivered in 1837 to the Swiss Society of Natural Sciences at its annual meeting in Neuchâtel. In this lecture Agassiz not only presented all the pertinent evidence for former extensive glaciation in the Alps, collected mainly by de Charpentier and Venetz, but he also introduced the concept of an ice age accompanied by a world-wide oscillation of temperature. Agassiz incorrectly envisioned a vast ice sheet extending from the North Pole to the shores of the Mediterranean Sea. He speculated that the ice sheet antedated the Alps and that it was disrupted by subsequent uplift of the Alps. In addition,

Agassiz attributed the ice age to biological causes which had no basis in fact. In spite of or perhaps because of its shortcomings, the lecture stirred up violent controversy and focused attention on the glacial theory. The second major work was *Studies on Glaciers*, published in September of 1840. This volume included chapters on the historical development of the glacial theory, on the early personal observations of Agassiz on Swiss glaciers, and on the theoretical aspects of the ice age. It was accompanied by an excellent atlas illustrating glacial features. Although it contained some of the original fantastic theories, *Studies on Glaciers* greatly advanced the glacial doctrine. One immediate result was its acceptance and incorporation in a publication on Massachusetts geology by Edward Hitchcock.

In the present volume Professor Carozzi has made a valuable contribution to the history of geology by translating and annotating both the *Discourse at Neuchâtel* and *Studies on Glaciers*. An extensive and excellent introduction places the contributions of Agassiz in historical perspective by recounting in detail the circumstances and personalities involved in the bitter struggle that preceded the final triumph of the glacial theory. The atlas that accompanied *Studies on Glaciers* is reproduced at reduced size. Because Agassiz corrected proofs for *Studies on Glaciers* at his field station on the Aar Glacier, many of the references in the original publication were inaccurate. In the present volume these have been corrected and altered to meet modern standards. Throughout the text Professor Carozzi has inserted timely annotations which clarify several erroneous passages and which explain some of the statements in the light of modern glaciological concepts. The volume is very well done, and geologists owe much to Professor Carozzi for undertaking to translate and to comment so expertly on these fundamental works of Louis Agassiz.

GEORGE DENTON

Loess Deposits of Mississippi; by E. L. KRINITZSKY and W. J. TURNBULL. P. 64, 12 figs., 4 pls. Boulder, Colorado, 1967 (Geol. Soc. America Spec. Paper 94, \$3.50).—The loess deposits of Mississippi, although they have been a topic of controversy for more than 20 years, have been described in detail in only a few papers. In this Geological Society of America Special Paper, Krinitzsky and Turnbull discuss the extensive surficial loess deposits of Mississippi in all their aspects—origin, stratigraphy, composition, physiographic expression, moisture regime, physical properties, and engineering considerations. A wealth of empirical data is presented. But, although the data on physical properties and engineering considerations seem certain to receive general acceptance, the report cannot be judged to have ended controversy on the matter of origin and stratigraphy of the loess.

The physical properties data for Mississippi loess include determinations of specific gravity, density, porosity, plasticity, shear strength, and consolidation. Specific test data for various depths are tabulated for a