Comments and Communications

Fourmarier's Suction Theory of Geosynclines, and the "Vertical Push" Explanation of Geanticlinal Orogeny

THERE seems to be no sign of a revival of interest in T. C. Chamberlin's central-compression theory to account for surface features by a progressive shrinkage of the radius of the earth; but the theory that thermal contraction is competent to account fully for paroxysmal alpine folding, as well as for relatively minor disastrophism, still has strong supporters, despite the radio-geological argument that the earth is not necessarily a cooling body.

Prominent among these supporters is Fourmarier,[1] who, however, rejects the classic concept of horizontal stress and movement, with development of crumpling and dislocation in a zone above a level of no strain (*asténosphere*) in the shrinking earth.

His arguments against movement of kratons as jaws of a vice, and in general against theories of crumpling in front of advancing flakes of rigid continental sial, are based on citation of examples of oval folded tracts, such as the Carpathians, eastern Alps, etc., to show that intensity of folding diminishes outward from an axial zone; such lateral thrusting as is evidenced comes from within rather than from without.

Fourmarier disagrees with the opinion of Suess that vertical movements in the crust are solely downward and are due to gravity acting in the zone above a level of no strain. He regards as of prime importance those movements (downward) due to "suction" along a shrinking radius of the earth (a force he calls "equilibrioturbal"), but recognizes as of great importance others (upward) that are due to the restoring ("equilibriopetal") effect of isostatic readjustment. Suction is appealed to as the force in the formation of geosynclines, where sinking is zonally localized because of absence of homogeneity in the substance of the earth. The possibility that kratons bordering such a sinking geosynclinal belt are drawn closer together is considered remote.

Although he pictures descent of the geosynclinal floor as taking place in response to the formation of a potential vacuum, the author assumes displacement of subcrustal material as a result of this descent—which seems inconsistent. There is also a shift of ground from belief in a rigid substratum, through which tension is transmitted, to an assumption of subcrustal mobility. Indeed, upheaval of adjacent belts, taking place as a result of lateral movement of displaced subcrustal material, is relied on to afford a source of supply of sediment to fill the geosyncline.

An essential part of any such hypothesis involving downward flexure is a halting mechanism. Subsidence becomes increasingly difficult as the light geosynclinal fill is carried down into a zone normally occupied by heavy rocks. Downward suction is resisted and eventually prevented by buoyancy; the potential vacuum shifts to some other—perhaps adjacent—weak zone; isostasy takes charge; and movement is reversed. The compression of the geosynclinal lens, of which there is evidence in the intense folding and dislocations of a tectogene, is attributable to a spewing-out that results from the pistonlike rise of a floor no longer drawn down by suction. The process of deformation must indeed have begun even earlier, during the descent, when at least some dips caused by incompetent folding have been developed, and deeply buried and strongly heated strata may have begun to crumple.

Fourmarier is satisfied with the quantitative efficacy of the theory of thermal contraction. He calculates that a lowering of the temperature of the earth's interior by 100° C would reduce its volume by 3.5×10^9 km^3, which would allow the formation of a basin 63 km deep over the whole area (5.6×10^7 km^2) occupied by mountain welts made during the last 150–180 million years. Such a reduction would obviously be more than sufficient to account for the geosynclines that have been filled. The claim that the reduplication of strata in folds and nappes can be explained by the spewing-out theory is not supported by figures. It may be strongly suspected that excessive estimates have been made by advocates of lateral-compression theories of the organic reduction in width of alpine belts, but Fourmarier would go so far as to claim that their widths have not been reduced at all.

C. A. COTTON

Victoria University College
Wellington, New Zealand

[1] P. Fourmarier, *Ann. soc. géol. Belg.*, **69**, B87 (1946); *Bull. soc. belge étude géogr.*, **17**, 20 (1947); *Ciel et Terre*. Bruxelles, **67** (1951).

Science Teaching in the Secondary Schools

PROFESSOR SCHRIEVER (SCIENCE, **115**, 96 [1952]) has called attention to the importance of training future science teachers for the elementary and secondary schools. Every potential scientist or engineer goes through these schools and is influenced by them. Also, in these schools most laymen, who become the general public, have their only organized associations with science and scientists, and the contact inevitably influences their attitudes and opinions.

Sadly neglected has been the fact that, despite the efforts of many colleges to revise their science instruction through general education courses, the great majority of people now—and surely for many years to come—complete their study and appraisal of science in the junior and senior high schools. This is immediately apparent when we realize that only about half our children graduate from high school, and that of the graduates only about one in six enters any higher academic institution. Even in college most students restrict their contacts with science to the legal minimum. What happens in the science courses in