

The edges of the Mexican table-lands (a term more correct than elevated valleys) show the counterparts of the submerged valleys to the east—an analogy not found in the valleys of the eastern part of the continent—for the now unsubmerged portions of the continent were too far from their margins to have been incised by the growing *cañons* of the period of great elevation. Yet these Mexican examples represent a shorter duration of time than the drowned Antillean valleys.

In Mexico youthful terraces occur to an elevation of 6,500 feet above the sea, and base planes of erosion upon the margins of the Mesas to an elevation of 8,000 feet. With this enormous elevation the terrace materials in the older valleys have not been removed by denudation except in part, and the youthful *cañons* have not yet reached far into the plains. Thus it appears that Mexico has risen to this great altitude in very recent times, and, when we correlate the geological foundations, it would appear that Mexico and Central America have risen to almost as great an elevation as the late altitude of the Antilles and eastern part of America, while the floor of the Mexican Gulf has been sinking.

Across the floor of the divide between the Atlantic and the Pacific, in the Isthmus of Tehuantepec, there were recent shallow straits, succeeded by natural canals covered with level gravel floors continuous with the terraces on the Atlantic side. The importance lies in the admittance to the Gulf of the sparsely-distributed Pacific littoral types of molluscs. But the gravel floors of the channels over the divides form a most important analogy. Such floors over the watersheds of the Great Lakes of North America have been regarded by some glacialists as evidence *per se* of glacial dams confining the waters of the lake basins at high altitudes. Against this view there are many considerations, but now that the same phenomenon is found within a few degrees of the Equator, and at low elevations, the value of this test for glacial dams disappears.

While no phenomena observed in the Antillean region have weakened the hypothesis of the great changes of land and sea in recent times, yet there is much detailed evidence supporting the theories set forth in the "Reconstruction of the Antillean Continent," of which the points mentioned have a most important bearing, as filling important gaps in the chain of evidence, concerning which we had not the direct observations before the present time.

VI.—SECOND NOTE ON THE EXPANSION THEORY OF MOUNTAIN EVOLUTION.

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IN a note published four years ago,¹ I pointed out a fundamental objection to the principle of the expansion theory. That objection has been clearly expressed as follows by Prof. Leconte,² who, like myself, considers it fatal to the theory: "Sedimentation

¹ GEOL. MAG., Vol. VIII, 1891, p. 210.

² Journ. of Geol., vol. i, 1893, pp. 570-571.

cannot, of course, increase the sum of heat in the earth. Therefore the increased heat of the sediments by rise of isogeotherms, *must be taken from somewhere else*. Is it taken from below? Then the radius [or rather crust] below must contract as much as the sediments expand, and therefore there will be no elevation. Is it taken from the containing sides? Then the sides must lose as much as the sediments gain, and therefore must contract and make room for the lateral expansion, and therefore there would be no folding and no elevation."

It appeared to me possible, however, that the sediment, owing to a less conductivity, might check the transmission of heat through it more than the surrounding crust, and that there might consequently be some, though certainly a small, relative elevation due to the cause invoked. This I now believe to be an error, for I was not then aware how greatly the presence of water can increase the conductivity of sand and rocks. That it does so is evident from the experiments of Professors Herschel and Lebour.¹ They find, for instance, that the conductivity of quartzose sand is .00105 when dry and .00320 when wet, that of New Red Sandstone is increased from .00250 when dry to .00600 when wet, and that of clay from .00250 to .00350. Now, considering that the average conductivity of crystalline and volcanic rocks is .00519, of schistose and slate rocks .00531, of different kinds of sandstone .00734 and .00323, of limestones .00561, and of argillaceous strata .00242, it is evident that I was wrong in supposing that the conductivity of *saturated* sediment might be small enough for it to act as a relative check on the passage of heat from the interior. I conclude, therefore, that the force of the objection, great as it was before, is increased by this additional consideration.

VII.—ON THE FORMATION AT LOW TEMPERATURES OF CERTAIN FLUORIDES, SILICATES, OXIDES, ETC., IN THE PIPERNOID TUFF OF THE CAMPANIA.

By Prof. H. J. JOHNSTON-LAVIS, M.D., F.G.S., etc.

WITH A NOTE ON THE DETERMINATION OF SOME OF THE SPECIES.

By Prof. PASQUALE FRANCO, M.D., etc.

WHEN such minerals as mica, pyroxene, nepheline, fluorite, and hematite are mentioned to us, we can hardly avoid associating their genesis with very high temperatures, and if amphibole be added we are equally bound to imagine also the existence of high pressure. So deeply rooted is this, I might almost say, superstition that few petrographers, when they find such minerals lining the fissures or cavities in rocks, fail to immediately conclude that great heat, and sometimes pressure, is indicated by such an occurrence. No doubt that in the vast majority of cases they would be right, yet I hope to show in these notes that such minerals have occasionally been produced under little or no pressure

¹ Brit. Assoc. Rep. 1881, pp. 130-135; quoted by Prestwich, "Controverted Questions of Geology," pp. 240-241.