two wrinkles could not possibly prevent the gas from traveling from one to the other and equalizing that pressure, and, as I have said above, could not possibly prevent the gas from getting out up the slopes of the geosyncline to the outcrops.

In the Gulf oil fields of Louisiana and Texas, it is still more clearly evident that the particular shape or structure of the salines or mounds was not a factor in the accumulation of oil from the surrounding sediments. These salines cover indeed such small areas that it is only a stretch of the imagination to suppose that the enormous quantities of oil obtained from under them could possibly be derived from the strata affected by what has been called the "quaquaversal doming" under the salines. Moreover, this doming does not extend to the Tertiary or Cretaceous clays and sands surrounding the salines or mounds; and therefore this particular structure could not be a determining factor of oil accumulations from the surrounding sediments. On the contrary, it is well established that the sediments under the salines have been replaced by masses of salt, limestone, dolomite, silica, sulphur, and gypsum, of secondary origin from solutions moving vertically and carrying hot oils, hot water, and hydrocarbon and sulphur gases, and that these products did not extend horizontally into the impervious sediments surrounding the chimney-like channels under the salines; also, that these salines are distributed along lines of deep faults which were evidently the first channels for emanations of the hydrocarbons and other vapors and waters, before they finally came out to, or near, the surface through the chimneys under the salines. What has structure to do with occurrences of oils in deposits of this kind, which are clearly due to the rock disturbance under the salines, and to hot gasaqueous emanations coming up from below? This explains the fact that oil in large quantities is "struck" at many different levels under the salines, and none is struck, outside of the salines, in the surrounding sediments.

That these are solfataric volcanic emanations is made plain by the occurrences of oil a little further south, along the same coastal plain, in Mexico. There one can actually observe numerous volcanic necks of olivine basalt, scattered at wide intervals, and also distributed along fault lines similar to the lines connecting the salines of Texas and Louisiana; and these volcanic necks are surrounded by large seepages of asphalt and the very prolific oil fields of this region are all developed in close proximity, around these volcanic rocks. F. G. Clapp in a paper in Economic Geology (vol. vii, No. 4, June, 1912) says with regard to this class of oil deposits in Mexico:

"In close proximity to the basaltic upheavals, the Tamasopo limestone and overlying formations have been domed upward, forming pockets or places of change in rate of dip at the base of the upheavals and surrounding them, where large deposits of oil have accumulated."

It is known, however, that these Mexican lava cores form really vertical pipes, which may be said to have drilled themselves upward through undisturbed and almost horizontal strata of shales, limestones, and sandstones, and Mr. Clapp himself admits that in his hypothetical cross-section of one of the Mexican oil-fields. The supposed action of the doming referred to by Mr. Clapp would therefore have been so infinitesimal as to be entirely negligible in considering the accumulations of oil out of the surrounding sediments. According to Mr. Clapp's theory the Cretaceous sediments surrounding the lava cones of Mexico tenaciously held back in their pores, during long ages, enormous quantities of petroleum products, until such time as the volcanic peaks and needles pierced through them in late Tertiary times. In doing so the volcanic cores tilted only very slightly the sediments immediately surrounding them. It would be impossible for this slight tilting of very small portions of the whole mass of the strata of this region to effect the immediate release from these sediments of the enormous quantities of oil supposed to have been so firmly held by them during long periods; and it can only be concluded that the effect of structure in this case at least has evidently been much overdrawn. Why should so much be demanded from poor impotent structure alone, when it is manifest that these Mexican petroleum deposits are directly connected with vulcanism, and due to solfataric volcanic emanations accompanying the upheavals of the basaltic cones?

Many other instances to show that structure is not a determining factor in the migration and accumulation of oil in the California fields may be found in the reports of Arnold, Anderson and Johnson. These authors summed up their conclusions as follows:

"This migratory faculty may be ascribed entirely to the presence of the associated gas which would cause the oil to fill every crevice offering a point of escape or a point of lodgment."

"The condition of the rocks is the chief factor that controls the matter of where the oil is stored most abundantly"

In California, "many of the 'oil sands' so called, are not true sands, but zones of fractured shale or flint offering interspaces in which the oil can gather."

"Large accumulations in anticlines may be accounted for primarily by the cavities offered by the strata along upward folds, and secondarily by the presence of less pervious beds arching over such folds and affording favorable conditions for the confinement of oil and gas tending to escape."

If to these conclusions is added the consideration of the many strong faults and disturbances always plainly in evidence in the fields of California, and also the consideration of the fact that in these fields a number of unconformable formations, from and including the crystalline gneisses to the Quaternary, are productive of oil, it will be readily understood that the migration of oil is effected vertically along fissures and from a source beneath the crystalline gneisses instead of horizontally and more or less under the determining influence of the structure.

The same conclusion has been reached by Washburne in the Florence field of Colorado: viz., that geologic structure has had little or no influence on the movement or the accumulation of oil which is present mostly in open fissures in a zone of shales 2,500 ft. thick, at the bottom of a syncline.

Geologic Facts.

Simple and well-known geological conditions and considerations prove just as conclusively that the occurrences of oil and gas in the strata can only be attributed to a process of infiltration, dissemination, and impregnation of the porous portions of the sediments from deep solfataric volcanic sources. As I have already on several occasions* presented in detail a number of facts and

*Natural Gas in Ontario, Journal of the Canadian Mining Institute, vol. iii., pp. 68 to 89 (1900). The Volcanic Origin of Natural Gas and Petroleum, Journal of the Canadian Mining Institute, vol. vi., pp. 73 to 123 (1903). Petroleum and Coals, Journal of the Canadian Mining Institute, vol. xii., pp. 273 to 301 (1909). The Volcanic Origin of Oil, Trans., xxxv., 288 to 297 (1904). Fallacies in the Theory of the Organic Origin of Petroleum, Transactions of the Institution of Mining and Metallurgy, vol. xxi., pp. 91 to 192 (1911-12).