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paraphrase): "Elohim Zebaoth, oh! turn now again, look from heaven and see, and remember in mercy this vine. And the vine-shoot which Thy right hand hath planted, and the King Messiah (*Malka Meshicha*), whom Thou hast established for Thyself." Here the parallel is drawn: vine = Messiah (David). As I quitted the chamber after my lecture, a friendly scholar gave me in passing another solution, in referring me to a passage of the Talmud (*Berachoth*, 57a) where it is said: "He who sees a choice vine in a dream, may look for the Messiah, for it is written (Gen. xlix. 11), 'He bindeth to the vine his foal, and to the choice vine his ass's colt.'" Rabbinowicz, in his *Varia Lectiones* to the Talmud, observes on this place that a Paris MS. of the Talmud bases this interpretation of the dream upon Ps. lxxx. 9 [8], for it reads, "A vine out of Egypt didst Thou transport, dravest out heathen and plantedst it." Thus here too the parallel is drawn, with an appeal in justification partly to Gen. xlix. 11, partly to Ps. lxxx.—vine = Messiah. The two references to the source of the figure in the newly discovered document of the early Church mutually supplement each other.

FRANZ DELITZSCH.

THE PROBABLE PHYSICAL CAUSES OF THE DESTRUCTION OF THE CITIES OF THE PLAIN.

GENESIS xviii., xix.

A RECENT interesting article in the EXPOSITOR by Dr. Cheyne, has induced me to return to the consideration of the physical causes involved in the destruction of Sodom and its companion cities, and has suggested some questions which had not occurred to me, when discussing this most realistic narrative, and comparing it with the appearances

on the ground, in my recent little book on "Egypt and Syria."¹

From a geological point of view we are scarcely warranted in saying that the recent researches of my friend Professor Hull, or those of Lurtet, and other previous observers have "disposed for ever" of the theory that the doomed cities or their sites, in whole or in part have been submerged under the waters of the Salt Sea; and I feel confident that Professor Hull could not assert that they have necessarily had this effect, though his own opinion in the matter may favour that view. What they have effectually disposed of is the theory that the Dead Sea originated at the time of the destruction of those cities, which is quite a different matter. There is indeed the best evidence that this salt lake has existed from early Tertiary times, and that in the ages preceding human history it was much more extensive than at present. But this does not settle the question whether at the time of the destruction of the cities it may not have been a little larger or smaller than at present, or whether there may not have been some local subsidence in connexion with the tragic event. The answer to these questions would depend on other considerations distinct from the geological history of the sea.

As to the size of the lake, this would be regulated by the relative amounts of precipitation and evaporation in the Jordan valley and the basin of the sea at the time referred to. As to local subsidence, nothing could be more likely than this in connexion with the disturbances recorded in Genesis. Such evidence as we have, however, gives no reason to believe that the climate of Palestine was less humid than at present in the time of Abraham. On the contrary, the probably greater amount of forest surface would justify the belief that it was at least less arid than in modern times. Further, if the country was better wooded,

¹ *Bye-paths of Bible Knowledge*, Religious Tract Society.

the floods of the Jordan would probably be less violent than they now are, and the level of the Dead Sea would be more constant. As to local subsidence, there are facts noted in a previous narrative in Genesis xiv., which give some reason to believe that this may have occurred. I take it for granted that as Canon Tristram and Dr. Selah Merrill have so ably argued, the cities were at the north end of the sea, and that the vale of Siddim in which their kings met the Eastern invaders was also there. Now these invaders are said to have marched up the western side of the sea by way of Engedi, and to have been met by their opponents in a vale or plain full of bitumen pits. At present it would be difficult for an army encumbered with plunder to move along the coast of the Dead Sea northward of Engedi, and it does not appear that the host of Chedorlaomer and his confederates went up the Engedi pass to the westward and round to the plain of Jordan through the hills of the Amorites. It is possible therefore that they may have passed along a fringe of low country now submerged, and in which were the petroleum wells. Tristram notes in this vicinity a band of bituminous rock in the cliffs and exudations of mineral pitch, but there seem to be no indications of the numerous petroleum pits referred to in Genesis, and possibly these may be now submerged. Nor would it be wonderful if the locality in question should now be occupied with deep water, since such local subsidence, occasioned by removal of material from below, might be of considerable natural amount. It is proper to add, however, that the disappearance of the bitumen pits may be accounted for in another way, to be noticed in the sequel.

It may be urged as an argument against the occurrence of any subsidence, that the notice of the locality in Deuteronomy xxix. 23, would imply that in the time of Moses the site of the destroyed cities was believed to be a land characterized by salt and sulphur and dryness, or in other

words a plain covered with deposits similar to that which occur in various places around the sea ; yet there is no contradiction between this and the supposition that a portion of the original plain had been submerged. What remained of it might present the characters of aridity and barrenness referred to.

With reference to the causes of the destruction of the cities, these are so clearly stated in a perfectly unconscious and incidental manner in Genesis xix., that I think no geologist, on comparing the narrative with the structure of the district, can hesitate as to the nature of the phenomena which were presented to the observation of the narrator. Nor is there any reason to suppose that the history is compounded of two narratives giving different views as to the cause of the catastrophe. On the contrary, the story has all the internal evidence of being a record of the observations of intelligent eye-witnesses who reported the appearances observed without concerning themselves as to their proximate causes or natural probability.

We learn from the narrative that the destruction was sudden and unexpected, that it was caused by "brimstone and fire," that these were rained down from the sky, that a dense column of smoke ascended to a great height like the smoke of a furnace or lime-kiln, and that along with, or immediately after the fire, there was an emission of brine or saline mud, capable of encrusting bodies (as that of Lot's wife), so that they appeared as mounds (not pillars) of salt. The only point in the statements in regard to which there can be doubt, is the substance intended by the Hebrew word translated "brimstone." It may mean sulphur, of which there is abundance in some of the Dead Sea depths ; but there is reason to suspect that, as used here, it may rather denote pitch, since it is derived from the same root with Gopher, the Hebrew name apparently of the cypress and other resinous woods. If, however, this were the inten-

tion of the writer, the question arises why did he use this word *Gaphrith* (גַּפְרִית), when the Hebrew possesses other words suitable to designate different forms of petroleum and asphalt. In this language *Zeptheth* is the proper term for petroleum or rock oil in its liquid state, while *Chemar* denotes asphalt or mineral pitch, the more solid form of the mineral, and *Copher* is asphaltic or resinous varnish, used for covering and protecting wood and other materials. As examples of the use of these words in the Pentateuch, Noah is said to have used copher for the ark, the builders of Babel used chemar or asphalt as a cement, and the careful mother of Moses used both chemar and zeptheth to make the cradle of her child water-tight. These distinctions are not kept up by the translators, but a comparison of passages shows that they were well understood by the original writer of the Pentateuch, who had not studied the chemistry of the Egyptian schools to no purpose.¹ Why then does he in this place use this quite undecided term *gaphrith*? The most likely reason would seem to be that he did not wish to commit himself to any particular kind of inflammable mineral, but preferred a term which his readers would understand as including any kind of mineral pitch or oil, and possibly sulphur as well. It would have been well if later writers who have undertaken to describe the fires of Gehenna in terms taken from the destruction of the Cities of the Plain, had been equally cautious. It is interesting to note in connexion with this, that in the notice of the pits in the vale of Siddim, the specific word *chemar*, asphalt, is used, and it is in this particular form that the bituminous exudations of the region of the Dead Sea usually appear.

It is scarcely necessary to say that the circumstances

¹ I do not know if it is necessary to apologise for assuming that Genesis is a Book of Moses. It is at least quite evident that its editor was trained in the schools of Egypt, and was better qualified to describe natural phenomena than the greater number of his critics and commentators in later times.

above referred to are not those of a volcanic eruption, and there is no mention of any earthquake, which, if it occurred, must in the judgment of the narrator have been altogether a subordinate feature. Nor is an earthquake necessarily implied in the expression "overthrown," used in Deuteronomy xxix. Still, as we shall see, more or less tremor of the ground very probably occurred, and might have impressed itself on traditions of the event, especially as the district is subject to earthquakes, though it is not mentioned in theological narrative.

The description is that of a bitumen or petroleum eruption, similar to those which on a small scale have been so destructive in the regions of Canada and the United States of America. They arise from the existence of reservoirs of compressed inflammable gas along with petroleum and water, existing at considerable depths below the surface. When these are penetrated, as by a well or bore-hole, the gas escapes with explosive force carrying petroleum with it, and when both have been ignited the petroleum rains down in burning showers and floats in flames over the ejected water, while a dense smoke towers high into the air, and the inrushing draft may produce a vortex, carrying it upward to a still greater height, and distributing still more widely the burning material, which is almost inextinguishable and most destructive to life and to buildings.

In the valley of the Euphrates, according to Layard, the Arabs can produce miniature eruptions of this kind, by breaking with stones the crust of hardened asphalt that has formed on the surface of the bitumen springs, and igniting the vapours and liquid petroleum.

Now the valley of the Dead Sea is an "oil district," and from the incidental mention of its slime pits, or literally asphalt pits, in Genesis xiv., was apparently more productive in mineral pitch in ancient times. It is interesting in connexion with this to notice that Conder found layers

of asphalt in the mound which marks the site of ancient Jericho, showing that the substance was used in primitive times for roofs and floors or as a cement to protect brick structures from damp, and it is well known that petroleum exudes from the rocks both on the sides and in the bottom of the Dead Sea, and, being hardened by evaporation and oxygelation, forms the asphaltum referred to by so many travellers.

The source of the bituminous matter is in the great beds of bituminous limestone of Upper Cretaceous age which appear at Neby Mousa, on the Jericho road and at many other places in the vicinity of the sea, and no doubt underlie its bed and the lower part of the Jordan plain. From these beds bituminous and gaseous matter must have been at all times exuding. Further, the Jordan Valley and the Dead Sea basin are on the line of a great fault or fracture traversing these beds, and affording means of escape to their products, especially when the district is shaken by earthquakes. We have thus only to suppose that at the time in question reservoirs of condensed gas and petroleum existed under the plain of Siddim, and that these were suddenly discharged, either by their own accumulated pressure, or by an earthquake shock fracturing the overlying beds, when the phenomena described by the writer in Genesis would occur, and after the eruption the site would be covered with a saline and sulphurous deposit, while many of the sources of petroleum previously existing might be permanently dried up. In connexion with this there might be subsidence of the ground over the now exhausted reservoirs, and this might give rise to the idea of the submergence of the cities. It is to be observed, however, that the parenthetic statement in Genesis xiv., "which is the Salt Sea," does not certainly mean under the sea, and that it relates not to the cities themselves but to the plain where the battle recorded in the chapter was fought at a time

previous to the eruption. It is also to be noted that this particular locality is precisely the one which, as previously stated, may on other grounds be supposed to have subsided, and that this subsidence having occurred subsequently may have rendered less intelligible the march of the invading army to later readers, and this may have required to be mentioned.¹

It seems difficult to imagine that anything except the real occurrence of such an event could have given origin to the narrative. No one unacquainted with the structure of the district and the probability of bitumen eruptions in connexion with this structure, would be likely to imagine the raining of burning pitch from the sky, with the attendant phenomena stated so simply and without any appearance of exaggeration, and with the evident intention to dwell on the spiritual and moral significance of the event, while giving just as much of the physical features as was essential to this purpose. It may be added here that in Isaiah xxxiv. 9 and 10 there is a graphic description of a bitumen eruption, which may possibly be based on the history now under consideration, though used figuratively to illustrate the doom of Idumea.

In thus directing attention to the physical phenomena attendant on the destruction of the Cities of the Plain, I do not desire to detract from the providential character of the catastrophe, or from the lessons which it teaches, and which have pervaded the religion and literature of the world ever since it occurred. I merely wish to show that there is nothing in the narrative comparable with the wild myths and fanciful conjectures sometimes asso-

¹ Lyell notices a subsidence as having occurred within the present century in Trinidad, which gave origin to a small lake of mineral pitch, and the well-known pitch lake of that island is supposed to have originated in a similar subsidence. The later subsidence is said to have caused "great terror" among the inhabitants, and if the petroleum or its gaseous emanations had been ignited serious consequences might have ensued.

ciated with it, and that its author has described in an intelligent manner, appearances which he must have seen or which were described to him by competent witnesses. I wish also to indicate that the statements made are in accordance with the structure and possibilities of the district as now understood after its scientific exploration. From a scientific point of view it is an almost vague description of a natural phenomena of much interest and of very rare occurrence.

Nor do I desire to be understood as asserting that Sodom and its companion cities were unique in the facilities of destruction afforded by their situation. They were no doubt so placed as to be specially subject to one particular kind of overthrow. But it may be safely said that there is no city in the world which is not equally, though perhaps by other agencies, within the reach of Divine power exercised through the energies of nature, should it be found to be destitute of "ten righteous men." So that the conclusion still holds—"except ye repent ye shall all likewise perish."

I may be permitted to add that, notwithstanding all that has been done in recent times, there is still much room for the application of natural science to the interpretation of the more ancient books of the Hebrew Scriptures, which are undoubtedly the productions of men of culture and of keen and accurate appreciation of nature, but which have come down to us through ages of comparative darkness in regard to physical phenomena—a darkness unhappily scarcely yet dispelled even from the higher walks of biblical interpretation.

J. WILLIAM DAWSON.
