

NOTICES OF MEMOIRS.

W. P. JERVIS ON EARTHQUAKES.

IL CAV. W. P. JERVIS, F.G.S., Keeper of the Royal Industrial Museum of Italy, has published his Lecture to the Philotechnic Society, Turin, on the nature and causes of Earthquakes, with especial reference to that of February last at and near Mentone. This is a careful study of the earthquake of 1887 in North-western Italy and the neighbouring parts of France and Switzerland, establishing certain facts and advancing some possibly new hypotheses. An earthquake-area being regarded as that in which the shocks have sufficient force to be sensible to man, this earthquake had no connection with any volcanic action, and the movements were not propagated to the volcanic region of Central and Southern Italy. An outward external area, including the parts where the seismic disturbance was manifested by very delicate instruments and magnetized bars, would, however, bring us nearer to the region of extinct volcanoes in Central Italy.

After a close examination of the disturbance of springs and fountains, caused by the sliding or derangement of strata close to the surface, the result arrived at was that Mont Mercantour in the Maritime Alps, west of the Col di Tenda, was the centre of seismic action. That mountain and others associated with it seem to have been the foci of an elliptical, but nearly circular, area of shocks, with its greater axis of about 485 kilometres. The length of the axes of the outer area of shocks perceptible only by seismic or other instruments cannot be determined, the movements depending on the nature of the rocks; probably they were twice the length of the other axes. The summit of the Maritime Alps, from a short distance N.W. of the Mercantour to the junction of the Alps and Apennines above Savona, seems to have divided the earthquake-area. That part towards the Mediterranean and the bed of the sea itself were subject as well to vortucose as to undulatory and subsultory shocks. The lateral boundaries were defined by slight fissures (from one to two or three millimetres wide) in the rocks or soil, in a direction perpendicular to the Maritime Alps, from near the Mercantour to the vicinity of Mentone, and from the mountains to near Savona. The vortucose action was most curious, especially near Mentone, where crosses and upper stones or statuettes of marble were turned round 30° or 45° in the Protestant cemetery. Elsewhere only undulatory and subsultory shocks were apparent. A table of places affected, duration of shocks, and geological nature of the ground is given. Some of the physiological effects before and during the earthquake are noticed, also the hearing of strange sounds in the stillness of the night, as if at a great depth underground.

The slow changes of level along the coast from Marseilles to

Genoa,—the sinking of Roman buildings below the sea-level at the coast-line near the former mouth of the Rhone,—and the fact of stone-boring Molluscs being found many metres above the sea-level in other parts—led Issel to say that this coast-line is subject to slow upheavals and depressions; and these Mr. Jervis believes to be due to the district being the area of repeated earthquakes similar to that of last spring. But as the earthquakes seem to be due to the descent or sinking of mountain-masses towards the centre of the globe, it would seem that they could not be repeated without the gradual lowering of the mountains. Mr. Jervis, however, proposes the hypothesis that there is an extra-mundane cause of upheaval of certain mountain-groups. Referring to Flammarion as being probably correct on the whole, though very poetic and too much of a scenic artist to follow details patiently, Mr. Jervis proceeds with the idea that the sun and moon, in certain positions, may be able to attract a given mountain-mass very gradually, and to an exceedingly small extent.—such process being repeated again and again, each time causing a still further elevation of insensible height. In time, unstable equilibrium having been produced (especially at given moments following the transient recurrences of celestial attraction), terrestrial gravitation interferes, and the upheaved masses settle down, in some instances with rupture of the strata. Thus there are two phases of the disturbance;—first, a gentle and imperceptible upheaval, so gradual as to be unappreciable by our senses, and never yet established, except on a coast-line where the sea-level gives a fixed point of comparison. This might, however, be as fully proved inland, were the heights of fixed objects on mountains (such as the summit of a building, a signal stone, etc.) determined with mathematical precision, instead of the ever-varying mountain-top (as Mont Blanc) being taken, which may be worn down one to twenty feet in a century by frost and rain, and possibly be again upheaved from time to time so as to restore the geographical relief.

The earthquake, as it is called, would then be the phenomena caused by the influence of terrestrial gravitation,—the fall by which stable equilibrium is secured. In the author's opinion the elevatory process by far exceeds that of depression, allowing full play for the ever-active erosion, by which the Alps, for instance, may have been worn down even hundreds of feet in historic times. Are not earthquakes, then, absolutely necessary for restoring in some parts of the globe the equilibrium of certain forces and agents, as electricity? Do they not help to maintain the balance between the heights of mountains and the depths of seas?

The defective method of buildings, especially with vaults, allow of much of the disasters in earthquake-areas, and the author points out some practical technical precautions and the building-materials most fit for use in these places.