

uniform in all directions, or is small compared with the surface-tension. This tension is merely a convenient way of expressing the resultant effect of the mutual attractions between the molecules upon the envelope. The curious myelin forms developed when certain fatty substances are dissolved in water are an interesting illustration of this phenomenon. It has recently been discovered that, while the interior is isotropic, the envelope is liquid-crystalline, and that the typical marrow-like shape results from the preponderance of the latter; the contour is circular when the envelope is thin. It was with some hesitation that Prof. Lehmann proposed the extended signification of the word crystal; it is, however, difficult to suggest an alternative, and, etymologically at least, a good claim may be made out for its use to denote the fluid form.

That crystals, when placed in the saturated mother liquor, grow and have the power of healing fractures are characteristics so similar to the attributes of certain of the lower organisms that they suggest the possibility of crystallised matter being a form of life; but a little consideration raises insuperable objections to such a theory. Prof. Lehmann's researches, however, throw fresh light upon the problem, and he ventures with some confidence to assert, not that crystals themselves are living, but that crystallisation is the agency made use of by living growth. A glass or jelly, or any other amorphous substance, does not grow; on cooling it passes gradually from the melted to the solid condition, and forms about a large number of nuclei, just as happens in the condensation of vapour. Crystallisation is a very different phenomenon; the growth is rapid and the nuclei are comparatively few. The distinction consists in the want of homogeneity of an amorphous substance, which results in the neutralisation of the intermolecular action. In such a substance doubtless several arrangements of the constituent parts are possible for equilibrium, and though there may be uniformity over a not inconsiderable region—judged by molecular dimensions—the resultant effect is chaos. Prof. Lehmann noticed further that liquid crystals, when under the influence of a magnetic field, coalesce and range themselves with their axes in the direction of the lines of force; in other words, the growth of an individual takes place. In fact, the similarity in aspect and behaviour between certain liquid crystals and bacteria is remarkable, and can scarcely be accidental. Prof. Lehmann suggests that in life the directional force is that mysterious essence so much discussed and so little understood—the soul. In support of this bold hypothesis he puts forward many cogent arguments and marshals an array of facts, but much work and consideration are necessary before it can be accepted with any confidence. Nevertheless, it must be admitted that Prof. Lehmann has made an important contribution to the solution of the great question confronting alike science and philosophy—what is life?

G. F. H. S.

METEOROLOGICAL REPORTS BY WIRELESS TELEGRAPHY.

THE British Meteorological Office is making arrangements in conjunction with the Deutsche Seewarte, Hamburg, for an experiment in the transmission of meteorological reports by wireless telegraphy. The intention is to make an experiment extending over a period of three months. It was anticipated that arrangements would be concluded in time for commencement with the New Year. It has been found necessary, however, to postpone the actual experiment until February. In the meantime the pre-

parations for the transmission to the Meteorological Office of reports from the ships of the Allan, American, Anchor, Atlantic Transport, Canadian Pacific, Cunard, Dominion, Red Star, and White Star lines have been completed, so far as they can be without trial, and the agents of the Marconi Company in London have already notified their officials to proceed from January 1.

There are many points as to instruments and other matters likely to arise which can only be solved by experience, and the position for effective cooperation will be improved by a trial of the arrangements in view. With this object, instructions as to observations and forwarding the information have been sent to the lines which are so courteously aiding this experiment, and full advantage is being taken to secure observations at once, and to avoid the loss of information for so important a month as January. Wireless telegrams from ships in different parts of the Atlantic may be expected now at any time. The disturbances which exert such an important influence on our weather, especially in the winter, arrive almost without exception from the Atlantic, and it is believed that observations showing the movements of these disturbances will materially add to our knowledge of the weather changes, and aid in weather forecasting.

THE ITALIAN EARTHQUAKE.

NEVER had earthquake taken such toll of human life as that which has just devastated Calabria. Hundreds had been killed by a single earthquake, or thousands, exceptionally the number had run to tens of thousands, but the Yeddo—now Tokio—earthquake of 1703, with its death-roll of 200,000, had stood in a class by itself; yet even this great number seems insufficient to count the deaths on the morning of December 28, 1908, and if to those whose lives were ended by the immediate effects of the earthquake we add the subsequent deaths from injury, exposure, and sickness, the loss will amount to well over a quarter of a million lives.

In face of such a disaster humanity, staggered at first, has thought of nothing but relief or palliation, and the daily newspapers, filled with accounts of destruction, misery and rescue, have contained little information from which we can form a proper judgment of the nature of the shock or its magnitude. This much, however, is clear, that the earthquake was of the first order, not so great, perhaps, as the Californian or Chilian earthquakes of 1906, but far greater than the Calabrian ones of 1905 and 1907, and as great as either of the celebrated earthquakes in 1783, which caused 40,000 deaths in the same districts as have just suffered an even greater loss of life.

From Pizzo the band of destruction extends southwards for about 50 miles through ill-starred Monteleone, which no earthquake seems to spare, Palmi, and Bagnara, to Reggio di Calabria. In Sicily Messina has been destroyed, and Gazzi, but except from this narrow strip of country we have few reports. Catanzaro suffered, to what extent does not appear, and at Cosenza the damage was great; in Sicily houses were destroyed in San Filippo, near Milazzo, and many were damaged in Caltanissetta and Noto, yet Catania escaped uninjured, and at Taormina only one building is said to have suffered any injury. The shock was felt, though slight, at Brindisi and Taranto, at Naples and Castellamare, and at Palermo the population fled in terror into the streets, though no damage was done.

From the interior of Aspromonte no news has come as yet, but the scanty information, summarised above, is enough to show that this earthquake, like most of those in Calabria and Sicily, was polycentric, originat-

ing, not from a single focus or centrum, but from a number of centres of greater intensity, the greatest of which lay close to the coast and for the most part beneath the sea. Moreover, it was no mere earthquake, but one of those great disturbances by which the whole world is shaken, which penetrate deep into its substance, and result in a permanent alteration of its shape. This would be sufficiently proved by the great sea wave which washed the shores of the Straits of Messina and the Tyrrhenian Sea, which swept over Messina and Reggio with a height of 30 feet, which caused three deaths at Catania and reached at least as far as Malta. This wave could only have originated in a great displacement of the bed of the sea, the nature of which is indicated by the narrative of the captain of the *Hopewell*; according to him, the boat, which was passing through the Straits at the time of the earthquake, seemed to leap into the air, as if a mine had exploded underneath her, and immediately afterwards a mountain of water was heaped up to starboard and rushed furiously towards Messina, while soundings showed that the bed of the sea had risen ten feet. This last statement requires confirmation, and only careful and extended surveys can define the extent and nature of the displacements which have taken place; but, even without these details, the breakage of all submarine cables, no less than the sea wave, show that the earthquake must have been accompanied by the production, under the sea, of a "fault" or dislocation of the surface, such as is not an infrequent accompaniment of very great earthquakes.

The most interesting and important question raised by this earthquake and its predecessors of 1905 and 1907 is whether the region may now look for respite or whether it is becoming unfit for human habitation, a question the answer of which requires a consideration of what is known of the cause of earthquakes and the past history of Calabria. Whatever may be the ultimate cause of an earthquake, there seems little room for doubt that it is of the nature of a gradually increasing strain, leading, in the end, to sudden rupture and the setting free of forces of which we still know little. Sometimes this strain will grow until the relief comes in a single great earthquake, with nothing visible or noticeable as a preparation or warning; in other cases we have had what, after the event, have been recognised as preparatory shocks. As an instance may be taken the Japanese earthquake of 1891, which gave rise to displacements along a fault-line 65 miles in length, and was preceded by minor earthquakes at either end of the line of this fault; it has been suggested, and the suggestion is plausible, that these gave partial relief to the growing strain, but that the ultimate effect of this partial relief was to equalise the strain along the line of the fault until finally no partial relief was any longer sufficient, and a general yielding resulted in the Mino Owari earthquake and fault.

Similarly, the shocks of 1905 and 1907 might be regarded as preparatory to the greater earthquake of 1908, and the supposition gains weight from the fact that they affected respectively the northern and the southern portions of the area in which the recent earthquake took its origin; but this interpretation suffers from the absence of any certain test by which we may know the preparatory shocks from the earthquake of which it is the forerunner, and be certain that the last of the trio is not itself preparatory to a still greater shock. Some light seems to be thrown on this question by the earthquakes of 1783; on February 5 of that year a severe and destructive earthquake ravaged much the same region as the shock of 1905; it was followed next day by an even greater earthquake, which, like the last, destroyed Messina, and was

accompanied by a great sea wave; other lesser but still destructive shocks took place on February 7 and March 28. It will be seen from this that the events of the three days of 1783 were not unlike those of the three years of 1905-8, and the analogy bears closer examination, so we may conclude that, as the great cataclysm of 1783 was followed by a sixty years' respite from destructive earthquakes, and the lesser one of 1638 by a twenty-one years' respite, so the disaster of 1908, though it will be followed by a series of after-shocks, some of which probably will be severe, may reasonably be expected to inaugurate a long era of comparative repose during which the population will have time to recover. But so long as it consents, or prefers, to huddle together in towns and villages which, however gratifying to the artist's eye, are villainously built, and designed in defiance of every precaution which should be taken in an earthquake-shaken country, so long will every earthquake of any degree of severity result in loss of property and of human life.

R. D. O.

Few precise particulars as to the physical characteristics and effects of the Italian earthquake have appeared in the daily papers. We are glad to notice that Prof. Ricco, director of the observatory at Catania, has been instructed by the Italian Government to study the causes and effects of the disaster. The following extracts, chiefly from reports in the *Times*, have been selected from a mass of descriptive material relating to the earthquake.

SEA WAVE.

An officer of the Italian torpedo-boat *Saffo*, carrying bread to Messina, has given the following account of the catastrophe:—

"At 5.20 a.m. we noticed the sea suddenly rising until it attained an enormous height, giving a violent shock to ourselves and all the shipping anchored in port, finally hurling itself with a deep rolling noise towards the quay, overturning a bridge and smashing to pieces most of the ships.

"A moment afterwards the surface of the sea appeared covered with wreckage and cargo, cases of paraffin oil, and boxes of fruit. An exceedingly dense cloud covered the city.

"Only at dawn was it possible to form an idea of the disaster. Almost the whole city was reduced to a heap of ruins. In the midst of all this ruin were still standing the walls of the Town Hall and the Trinacria Hotel. The streets were completely obstructed in several parts of the city, which were now reduced to ruins. Red flames arose, accompanied by huge columns of smoke."

The captain of the Russian cruiser *Admiral Makaroff* states that the great shock lasted 37 seconds, and was followed by four huge waves, while minor shocks continued to be felt during the whole time that his crew were engaged in the work of rescue.

The sea wave which followed the earthquake invaded Reggio so far as the Corso Garibaldi, namely, more than 10 metres above sea-level. The houses near the sea were flooded up to the first storey, and several were washed away by the waves. Twenty-nine miles of railway have been destroyed, and all the stations near Reggio are in ruins.

A man who was just embarking on a ferry-boat to go from Messina to Reggio when the shock occurred describes how the level of the water seemed suddenly to descend until the ferry touched bottom, and then rose to a great height again—he says eight yards—hurling the ferry-boat on the landing pier, which smashed it to pieces.

METEOROLOGICAL CONDITIONS.

On Sunday, December 27, heavy rain fell in the afflicted district, the downpour during the night being torrential. At about 5.15 a.m. on December 28 three distinct and long earthquake shocks are said to have been felt at Messina. Only a little rain fell on that day, but there

was heavy rain at night and all Tuesday, when there was also a high wind.

Almost immediately after the earthquake the very cold weather in northern Russia suddenly changed, and the weather resumed its normal state.

AFFECTED AREA.

The sea-wall in front of the city of Messina has been broken up and has fallen, and the sea-walk has sunk under the water. Prof. A. Ricco, the director of the observatory at Catania, states that the docks and other harbour works at Messina have sunk to the level of the water.

At Reggio the destruction seems to be even more complete than at Messina, for the whole of the city has been razed to the ground. The greater part of the sea front is under water. The whole area of the ground below Reggio seemed to have turned over, and a great part of the city is in ruins, covered by the sea. In many places deep chasms appeared in the streets. Of all the villages looking towards Reggio on the coast, not one has been left standing.

The Prefect of Reggio states that the centre of the town has settled down to the sea-level, and only the small villas on the promenade between Reggio and Campi, situated on the highest point of the town, remain standing. The sea front has been swept away, while the water in shore is blocked with sunken débris. Access by sea is impossible, and the town cannot be approached by land, as for a radius of eleven miles the country has a torn and twisted appearance, roads, bridges, footpaths, and railway lines being uprooted. The face of the country has changed, and big fissures in the land have appeared.

The greatest damage was done in the low-lying and unfortunately most important portions, but both at Reggio and Messina this seems to have been due to the actual shock of the earthquake. The subsequent wave flooding the lower houses is said to have risen gently, and does not appear to have added much to the total damage.

In Reggio all the new houses of not more than 32 feet in height have resisted the shock completely. The houses along the Via Marina and the Corso Garibaldi on the sea front fell down to the first floor. Many of the old houses lost their walls on the side which faced the sea to the north. The new dwellings erected at Ferruzzano by the Milan Committee after 1905 have suffered no damage, though they were severely shaken; this is attributed more to the fact of their limited height than to their special construction.

The Admiral-Superintendent of Malta Dockyard has requested the Collector of Customs to make it known that the statement that the Straits of Messina are unrecognisable is incorrect. The topography of the Straits is said by him to be unaltered.

A message from Rome on December 30 states that the submarine cable with the Ionian Isles is broken, and it is feared that the earthquake may have caused damage in the group.

The commander of a torpedo-boat, which was sent to inspect the Lipari Islands, has informed the Ministry of Marine that the shock of December 28 was very severe, and that several buildings were cracked, but that no one was killed.

Prof. Ricco informed a correspondent of the *Daily Mail* that the earthquake had its maximum violence in Sicily and at the southern point of Calabria. The ruin spread from Castoreale, in Sicily, to Palmi, in Calabria, or a distance of forty miles. Damage to buildings occurred from Riposto and Patti, in Sicily, to Pizzo, in Calabria, a distance of eighty-six miles. The earthquake was felt violently from Mistretta and Noto (Sicily) to Cosenza (Calabria), a distance of 186 miles. It was felt, though only slightly, at Marsala and Trapani (Sicily), and even in Naples.

Taormina has escaped unscathed, except that the hotel San Domenico, occupying the site of the old Dominican monastery, has been somewhat damaged.

SEISMOGRAPHIC RECORDS.

The seismographic instruments at Laibach Observatory registered the earthquake at 5.22 and 6 a.m. Of twelve

instruments, only one was able completely to register the successive shocks, as the oscillations were more violent than the instruments could measure. The maximum oscillation was registered at 5h. 26m. 16s. The seismic commotion noted at Ekaterinburg, and other observations, indicate that the wave of the disturbance moved south-west to north-east Europe.

The seismograph at Perth Observatory, Western Australia, recorded the earthquake, showing vibrations apparently at two periods of maximum intensity.

SUBSEQUENT DISTURBANCES.

A slight further shock was felt at Palermo on December 30. There was a more violent shock at San Marco Argentino during the night of December 29, accompanied by prolonged subterranean noise. Many houses were damaged, among them the church and the public buildings.

Shocks, less severe but always accompanied by subterranean rumbling, were felt in many places in Calabria during December 31.

Two earthquake shocks were felt at Algiers at about 6.30 p.m. on January 1. The shocks lasted about three minutes, and damaged some telephone wires.

Etna, Stromboli, and Vulcano were quiescent before and throughout the earthquake disturbance. On January 3, however, at 5.22 a.m., a violent shock of earthquake lasting three seconds was felt in the island of Stromboli. It was accompanied by an eruption of the volcano and prolonged subterranean rumblings. Buildings were seriously damaged, many houses being rendered uninhabitable.

At 11.44 p.m. on January 4 a shock of earthquake was felt at Tenerife, lasting twelve seconds. Bells were rung in the houses, and furniture was overthrown.

SUMMARY OF PHENOMENA.

The Rome correspondent of the *Times* gives the following details of the earthquake in telegrams on January 2 and 4:—Among the phenomena which accompanied the movement the most notable is the wave which swept both shores of the Straits. The accounts as to the height to which the sea rose vary enormously. At Riposto, on the Sicilian coast, it was said to be 10 metres high. That seems to be an exaggerated estimate, and no doubt more exact knowledge will be soon forthcoming. All the survivors speak of the subterranean rumbling sound, which they generally describe as a dull roar that seemed beneath and around them, simultaneous with the first shock, and lasting during the subsequent shocks. Of the number, frequency, and violence of the subsequent shocks there are again very varying accounts. The apparatus in the Observatory of Mileto, Calabria, had registered twenty-eight shocks before it was destroyed. Vast fissures in the ground are reported at both Reggio and Messina. At Messina some eye-witnesses declared that the ground seemed to throw out stones, which were hurled to a considerable distance. The weather conditions of those days have their significance. There was a marked depression in the extreme south of Italy two days before. On both December 27 and 28 it rained, and on the night of December 27 it rained in torrents. Rain fell again at intervals throughout Monday and Tuesday (December 28 and 29), and on the latter day it was accompanied by a violent wind.

Prof. G. B. Rizzo, who fortunately escaped from his fallen observatory at Messina, states that the action of the sea wave has been much exaggerated. In his opinion, the shock on the Sicilian side of the Straits caused a movement of water against the Calabrian side, followed by a re-flow against the Sicilian side and Messina, naturally with less violence. Very little loss, he thinks, was caused by the wave at Messina, where the sea hardly advanced ten yards beyond the sea-wall. What is really remarkable, and should be the object of careful study, is the raising of the level of the seashore; Prof. Rizzo noticed that several boats anchored some distance from shore were left high and dry. On the other hand, the ground has sunk in some places in the city, notably near the Municipal Palace and Via Seminario, where in one place it has fallen eleven yards.