

conception was developed in a series of memoirs dealing with chemical types, and was later on generalised and simplified by Charles Gerhardt.

"Dumas' studies embraced every branch of the science—discovery and description of mineral and organic compounds, analysis of numerous substances and improvement of the methods of analysis themselves, determination of atomic weights. With the penetration of inventive genius he introduced into all his researches that firm grasp of the subject, that accuracy in details, that critical spirit which are the essential conditions and necessary instruments of all scientific investigation.

"And how shall I speak of his theoretical views expressed on a great variety of special subjects, and embodied either in his great 'Traité de Chimie Appliquée aux Arts,' or in his admirable 'Leçons de Philosophie Chimique'? Merely to mention one point, to Dumas we are indebted for a first attempt at a classification of simple non-metallic bodies, an attempt which has still its value.

"Let me also remind you that, after enriching physiological chemistry at the outset of his career, he soon after endowed physics with a new method for determining the densities of vapour, in continuation of the work begun by his master, Gay-Lussac.

"But a complete idea of his influence and authority cannot be had without reference to his career as a teacher. On his arrival in Paris he opens a course of lectures at the Athénæum. Later on he founds, jointly with Lavallée, Ollivier, and Pécelet, the Central School of Arts and Manufactures, where he conducts the chemical class for a quarter of a century. In 1832 he replaces Thenard at the Polytechnic, and the same year is appointed Assistant Professor to the Faculty of Sciences. In 1841 he becomes at once Titulary and Dean of the same Faculty, having three years previously obtained the Chair of Organic Chemistry in the Faculty of Medicine. It was here perhaps that his talents as a teacher achieved their greatest triumphs. He was at that time at the most brilliant period of his creative genius, and he set forth the great ideas then animating him with sympathetic warmth and persuasion, with 'inimitable clearness and wealth of illustration.

"Such, in a few words, has been the preponderating part played by M. Dumas in science and instruction. And although during his last years he withdrew from public life, it was only to devote himself to work of another order. He was equal to every undertaking imposed on him, the soul of the many committees over which he presided, the ornament of the Academic celebrations which he honoured by his presence and addresses. And after such a long and glorious life what remained except a peaceful end in the midst of his family circle, and in the full enjoyment of all his faculties? But such a commanding figure cannot pass into forgetfulness. Your memory, Dumas, shall be perpetuated, your name transmitted from age to age. You shall live in your works, in the example you have given, in the immortal productions and rare qualities of your mind: *Forma mentis æterna.*"

THE EARTHQUAKE

EARTHQUAKES are so rarely observed in England, that an exceptional interest attaches to that of April 22, an interest far in excess of that due to its intrinsic importance. Fortunately the earthquake is exceptional in another sense. It is seldom that a shock results in so small a loss of human life in proportion to the damage done to houses.

The daily London press, for a few days after the occurrence, gave much information as to the range of the earthquake, and the nature and amount of the damage done; further details are given in the local papers of the Eastern Counties, but we are still sadly in want of definite statements upon many matters of great importance. In

this article we shall notice only a few points of interest, reserving for a later issue, it is hoped by the aid of fuller knowledge, a more complete account of the phenomena, to be illustrated by a map showing the area of disturbance.

The shock was most severely felt near the north shore of the estuary of the Blackwater, and for about six miles inland to the north, in the direction of Colchester. The geology of this district is simple. Nearly all the country is occupied by London Clay; over the marshy land of the Colne, and the flats separating Mersea Island from the mainland, there is a covering of recent alluvial deposits; over parts of the higher land of Mersea Island there are patches, from a quarter of a square mile to one square mile in area, of Glacial gravel, the remnants of a great sheet of similar material which once overspread the London Clay and joined the large area of similar gravel near Colchester. This town is mostly built on gravel, which rises to a greater height, and occurs in considerable thickness, to the south-west of the town—over Lexden and Stanway Heaths; further to the west and south-west this gravel passes under Boulder Clay. Underlying the whole of the Tertiary beds of the east of England there is a continuous bed of Chalk, from 600 to 1000 or more feet in thickness. Below the Chalk there is a bed of Gault Clay of varying thickness. But here our certain knowledge of the geological structure of the country ends. Rocks of Silurian, Devonian, or Carboniferous age have been proved at various points under the east of England—at Harwich, Ware, Turnford, Tottenham Court Road; rocks of probably Triassic age have been found at Crossness and Richmond. Still further west and north-west the older rocks have been proved at Burford and Northampton. Over Central England the Jurassic and Triassic rocks cover a wide area, but from beneath these the older rocks appear in numerous places.

One of the most interesting questions connected with the recent earthquake is to ascertain whether there be any relation between the known range of these older rocks and the range of the earthquake over areas far distant from its central spot. At first it seemed certain that such was the case. The shock was plainly felt at Bristol, Wolverhampton, Birmingham, and Leicester—all places on or near to the outcrop of the older rocks. Numerous intermediate localities have since been mentioned, many not being connected, so far as we yet know, with the near existence of older rocks; but the far distant places still make it probable that some such connection exists.

It seems therefore likely that the wider and more general range of the earthquake is connected with the range of the Palæozoic rocks, whereas the local phenomena depend very largely upon the nature and thickness of the Secondary and Tertiary rocks. It is therefore important that those who study in detail the effects of the earthquake on the spot should do so with the aid of the Geological Survey Map of the district, which was surveyed by Mr. W. H. Dalton. The map and explanatory memoir are both published; in them the nature of the drift deposits are fully explained.

Almost all earthquakes have a very striking effect on springs and wells, sometimes causing a permanent change, at other times having merely a temporary influence. It is somewhat remarkable that so little has been recorded upon this point. A strong spring at West Mersea, which issues at the base of the Glacial gravel, where this bed rests upon London Clay, is said to have ceased to flow for a short time, and to have been discoloured when the water returned. Any residents in the district who have the opportunity of inquiring into similar cases, which doubtless occurred, will do good service by noting the facts.

Dr. J. E. Taylor's letter, which appears elsewhere, contains much valuable information, such as might well be collected from neighbouring areas; his observations as to the twisting of chimneys, &c., and as to the direction in which that twist occurred, is a case in point.

Information is also wanted as to the angle at which the shock emerged from the ground at various points around the central area, in order that the depth from the surface at which the shock originated may be known. There should be no difficulty in collecting data for this in a district where so many buildings are cracked and shattered. The direction of the cracks, and the angles which these cracks make with a horizontal line, should be carefully noted.

Another point upon which much uncertainty at present exists is the direction in which the wave travelled from its point of origin. The swinging of chandeliers, the swinging of pictures on certain walls and not on others, pendulums which stopped or not according to the direction of the swing, are all important helps towards deciding this question. Of course it is always dangerous to seek for knowledge of this kind some time after the event, but in many cases it may be possible to speak with absolute certainty of the facts.

Some observers speak decidedly of two distinct shocks; this probably was the case frequently, though seldom noticed. The rumbling sound so frequently accompanying earthquake shocks was in many cases noticed in Suffolk and Essex. It is rarely mentioned elsewhere, but is said to have been heard at Chelsea, Reading, and Bristol.

As regards the actual area affected by the shock, there is perhaps much yet to learn. It is recorded along the south side of the Thames from Herne Bay to London, and again at Reading. It was felt at Maidstone and Croydon, and again along the south-east coast from Hastings to Portsmouth and Ryde. But at present we know of no observations in the central parts of Kent, Surrey, or Sussex.

W. TOPLEY

WE have received the following further communications in reference to the earthquake:—

As all facts connected with the earthquake shock on Tuesday may prove of more or less value, I beg to communicate the following. The house which I occupy is situated in the centre block of buildings constituting Inverness Terrace, on the western side. Under this block of houses runs the Underground Railway, but a distance of one hundred paces from my house. During the daytime the passage of trains is wholly unperceived, but during the night, when heavy luggage-trains run, a very perceptible vibration is experienced, and in the stillness a distinct rumbling is heard. On the morning of Tuesday I was engaged reading, when my attention was called to what I supposed to be the passage of a train; but the peculiarity of the motion speedily undeceived me. The sensation was that of being borne rather on water than on solid earth, and as I had already had experience of an earthquake shock in India, I suspected that this disturbance I was feeling was of the same nature. I immediately looked at my watch and noted the time as being thirty-two minutes past nine o'clock. As no one of the other three inmates of the house had perceived anything unusual, I thought no more about the matter until I saw the announcement in the evening papers of what had happened. I then went to the watchmaker's and found that my watch was just fifteen minutes too fast. I am therefore able, with fair approximation to accuracy, to fix seventeen minutes past nine o'clock as the time at which the vibration ceased at this point.

W. C. B. EATWELL

69, Inverness Terrace, Kensington Gardens, W., April 24

ON Wednesday morning last, the day after the earthquake, I determined to start upon its track. In Ipswich here, little or no visible harm has been done; but no sooner had I arrived at Colchester and commenced to walk through the town, from the chief station to the Hythe, than abundant evidence of the ruin wrought by it was visible. Chimneys were totally thrown down, and the brickwork had crashed through the frail roofs. Others were standing, but they looked as if they had been struck by lightning. Their upper parts were splintered and laterally expanded. I could not help noticing that nearly all the houses whose chimneys were wrecked were the oldest—hardly any of the modern, cheaply-built cottages being affected, contrary to my expectation.

At Wivenhoe I found the appearance of the town best expressed by the remark already made: "It looked as if it had been bombarded." That was the first idea which rose in my mind.

Hardly a house was untouched, inside or out. The newest houses seemed to be externally least affected, but they made up for this inside. They looked as if they had been given a few half turns, and then shaken up. The plaster had been detached from all the walls, the roofs were rent and loosened all along the cornices, and the framework of the windows was everywhere splintered or free. The battlements of the grand old church had been thrown down, and about fifteen tons of rubbish lay among the crushed headstones and the delicate and abundant grave flowers. Here again there was evidence of a semi-rotatory motion on the part of the earthquake. The beautiful Independent Chapel is so utterly wrecked within and without that it will all have to come down. The streets were full of bricks, mortar, and tiles, although with characteristic English tidiness and diligence the terror-stricken inhabitants were already clearing away the debris. I noticed several houses with rents at the bases of their walls, and in such of the chimneys as remained standing they were frequent. One thing struck me, the rents sprang at an angle of about 30° at the bases of the buildings, whilst in the chimneys this was increased to from 40° to 45°.

The old ferryman related his experience after the manner of an old salt. He was just bringing his boat to the shore when the shock occurred—"it seemed just like *three seas*," he said—a capital and vivid expression to convey an idea of the wave-motion.

Crossing the river I made my way through Fingrinhoe village, and on to Langenhoe. I did not see a single house on the road, large or small, for a distance of about four miles, that had escaped untouched. The fine old Jacobean hall at Fingrinhoe has lost the upper part of the western side of the front elevation. Here I found some of the chimneys that had been left standing *twisted* on their pediments. I carefully noted this on the way, and on examining those of the massive chimneys of the rectory at Langenhoe, the torsion was very plainly visible. The twist had come from the south, for the faces of the chimneys which had previously looked in that direction were now turned almost south-easterly. I did not set out a minute too soon to note these circumstances, for all the builders of the countryside were already abroad, and in a few days all the evidences of earthquake action of the greatest value to seismologists will have been completely obliterated. Thus I found a very intelligent builder from Colchester on the lawn of the Langenhoe Rectory, giving orders for having the twisted chimneys removed, and I have no doubt they were all taken down within twenty-four hours. He had been driving all over the disturbed countryside, and told me that wherever the big chimneys had been left they were twisted from the south-south-west to the north-north-east, especially in the contiguous villages of Peldon and Abberton. This, I think, settles the original direction of the earthquake wave, and also establishes its rotatory character.

Langenhoe Church is an utter ruin, and all that yet stands will have to come down. It is a sad sight to see this picturesque, ivy-clad old church—standing so prettily overlooking the creeks where the ancient Danish Vikings landed in the dawn of our modern history but a comparatively few years before the church was built—now so utterly ruined. The porch on the north side is of brick, and a modern structure. Two large rents run up, one on each side of the doorway, at an angle of about 32°. They run from opposite directions, and meet just above the keystone of the arch. Here another large rent parallel with the ground traverses the masonry. It seemed to me that the first earthquake shock which rent the brickwork sprang from the western corner, and was reflected so as to form the opposite rent, after striking and lifting up and forming the parallel crack above-mentioned.

The battlements of Langenhoe Church, like those of Wivenhoe, have been shaken down. But while those of Wivenhoe were thrown upon the ground chiefly on the *west* side, those of Langenhoe Church were thrown on the *nave*—that is, in an opposite or *easterly* direction. They crashed through the roof and carried a gallery with them, the concussion meantime bursting out the upper part of the chancel end. Am I right in thinking that this pitching forward of the loosened rubbish in opposite directions, as exemplified in these two churches, taken in connection with the overwhelming proof of rotatory motion, indicates that the movement of the earthquake had swerved right round be-

tween Wivenhoe and Langenhoe? In that case does it not also suggest the *local* character of the earthquake?

Langenhoe and the adjacent villages, with the Isle of Mersea close by and in full view, appear to form the focus of the disturbance. So far as I have been able to learn, the clocks stopped by the shock were those facing the north.

I see the newspapers refer to various cracks and fissures in the ground at Langenhoe, Abberton, Mersea, and elsewhere, as having been caused by the earthquake. I saw numbers of them, but in every instance they were the ordinary cracks which always appear in the London Clay during a drought, or after a spell of dry weather like that of the last three weeks. In none of the instances I saw had the fissures anything to do with the earthquake.

The local character of the area of chief disturbance is not only indicated by the different directions in which the rubbish was thrown from the battlements of Wivenhoe and Langenhoe Churches relatively, but also by the fact that whilst the western side of Mersea Island suffered severely, the eastern side was only slightly affected in comparison.

Museum, Ipswich, April 26

J. E. TAYLOR

THE earthquake was felt here very plainly, and I am able to give some evidence as to the amount of oscillation experienced at the moment when the wave passed under Cambridge. I happened to be looking at my marine aquaria at rather more than twenty minutes past nine on Tuesday morning (I regret I did not notice the *exact* time, but that was about it), and the water in them distinctly moved. The oscillation was not violent, as if produced by a concussion in the air, such as an explosion would cause, but rather as if the table on which the aquaria stand had been tilted up to the extent of an inch, and in the direction of a line running east and west. I was looking more particularly at a very shallow aquarium in which I keep shrimps, mussels, and sand-loving annelids, and one portion of which has less than a quarter of an inch depth of water. This was tilted up so much that the sand at the shallow end was quite uncovered by the water, and my first thought was that evaporation had taken place during the preceding night to such an extent as to endanger the lives of the nereids and other creatures; I therefore went hastily for some fresh water, but upon returning with it in a minute I found the water at its normal level, and I had no necessity to pour any fresh in. I remember, too, that I was sensible of a slight giddiness at the time, and the house and everything in it seemed to be moving. The sensation indeed was much like being on ship-board. I had no suspicion of the real cause, but thought it was a slight faintness, as I had not then breakfasted.

Mill Road, Cambridge, April 23 ALBERT H. WATERS

The following memoranda may be of interest:—On January 8, 1869, I was with Prof. Dawkins, engaged in examining the late Mr. Whincopp's collection at Woodbridge, Suffolk. On my way home I was delayed three hours at Bury St. Edmund's in consequence of a luggage-train having broken down to the eastward. While there I was told that an earthquake had been felt that day at Thurston, Elmswell, and Haughley, places between Ipswich and Bury. It was reported that a workman, sitting eating his luncheon on the bank, saw the rails move. Mentioning this when I returned home, I was told that the policeman in this village had felt a shock. I therefore interviewed him and made the following note:—"January 15, 1869; P.C. Redhouse, when near the 'Hare and Hounds'" (which is a few hundred yards south of my house) "on Sunday morning the 3rd, about 2 a.m., heard a sound like heavy distant guns, which seemed to shake him and to make him reel. He was walking fast, and stopped. There was no shake after the sound. He thought there were six or seven reports in a couple of seconds. The movement was from north to south. There were three sounds before he stopped, and three afterwards. He did not regain his steadiness for two or three chains' distance. The sounds were very heavy, and he went home in alarm." I was awakened the same night by a tremor of the bed. This occurred a week before the shock in Suffolk. The late earthquake was preceded at Langenhoe by a slighter one on February 18.

A yacht captain at Wivenhoe happened, on the 22nd inst., to witness the effects from the top of a ladder. Hearing a rumbling sound, he looked about him and saw the church and all the houses rocking about, some one way and some another, "like a lot of pleasure-boats at the seaside with a gentle swell on." This seems to show that the length of the wave could not have

been great, but that it must have been in opposite places within a few hundred yards. Knowing the district well, it strikes me as remarkable that the strength of the shock should have been so much localised, while the distance over which it was slightly felt was so extended.

O. FISHER

Harlton, Cambridge, April 28

ALTHOUGH this Observatory does not possess a seismograph, yet the passage of yesterday's earthquake wave was recorded by the magnetographs, although I am not aware the shock was felt by any one in this neighbourhood. It was registered at 9.17-18 a.m. G.M.T., and from the fact that the disturbance of the horizontal force magnetometer was the greatest, we infer that the terrestrial movement was rather north and south than east and west.

G. M. WHIPPLE

Kew Observatory, Richmond, Surrey, April 23

PROBABLY one of the extreme limits of the action of the earthquake of April 22 was at Street, Somerset, ten miles beyond the Mendip main anticline. There it was *certainly* felt by an invalid lady, who mentioned it at midday dinner, only a few hours after, no news having been received, of course, from other parts. Has there been any certain record of it north of the concealed Palæozoic ridge across the North Midland counties?

York, April 28

J. EDMUND CLARK

NOTES

AT the meeting of the Executive Committee of the City and Guilds of London Institute held on Tuesday, the following appointments were made at the Central Institution, Exhibition Road:—To the Professorship of Chemistry, Henry Armstrong, Ph.D., F.R.S., of the Technical College, Finsbury; to the Professorship of Engineering, W. C. Unwin, D.Sc., of the Royal Engineering College, Cooper's Hill; to the Professorship of Mechanics and Mathematics, Olaus Henrici, Ph.D., F.R.S., of University College, London; to the Professorship of Physics, Oliver Lodge, D.Sc., of University College, Liverpool.

IN a crowded house on Tuesday last the Convocation of the University of Oxford passed the much-debated statute allowing women to enter for "certain of the honour examinations of the University." The statute has been opposed on very different grounds. The old Conservative Oxford School (fast becoming extinct among the resident teachers) of course objected to any change in favour of the higher education of women; with them went a portion of the High Church party, who look with disfavour on any proposal tending to bring women into intellectual competition with men. Others, again, opposed the statute on the ground that it was unfair to men, who have to keep certain terms and pass certain examinations within a specified time if they wish to enter for an honour school, whereas the statute allows women to enter for honours without the same preliminary examinations, and without restrictions as to time and residence. Others again feared an influx of young ladies into Oxford, as likely to destroy the manliness of the undergraduates and spoil the natural modesty of the lady students. To these arguments the success which the present halls for ladies in Oxford have met with is the best answer. Their presence has not revolutionised the University; they have not been a stumbling-block to discipline nor a rock of offence to the Church. The women's examinations, conducted by the delegates, were exactly on the same subjects, and the papers were set by the same men, as in the men's honour examinations before this statute passed. Now the same papers will serve for both, trouble will be saved, and the women who obtain honours will win a certificate universally recognised throughout the country. Oxford is to be congratulated on Tuesday's vote.

THE Rede Lecture at Cambridge University will be delivered on May 28 by Mr. Francis Galton, the subject of the lecture being "The Measurement of Human Faculty."