

there are some remarkable examples, houses forming south-east and north-west corners were exceedingly damaged, viz. south-east was the direction where the first shock came from.

In the environs of Agram the earthquake appeared with no less strength than in the town itself, but the damage to the surrounding country is not so general, because here are the peasants' cottages all built of wood. Here therefore only the churches, the parsons' houses, schools, castles, and gentlemen's private houses were the objects on which the earthquake left visible marks.

All the buildings of any strength in the villages which are situated at the south-east slope of the mountain called Sleme, north from Agram, were damaged in a more or in a less degree; there is for instance the well-known place for pilgrimages, Remete (5 km. north of Agram), where the walls of the church, which is ornamented inwardly with very beautiful frescoes, and of the steeple are strongly gaped in all directions, while the vaulted roof of the nave is totally fallen down; so is also the residence of the parson; the damage caused in these two edifices amounts, according to an official valuation, to 38,000 florins. In Grancsina (7 km. north-east from Agram) the steeple, falling down in an easterly direction, broke through the roof and the vault of the church, so that now one can see only the four very ruptured walls. On the other side of the mountain Sleme, in a certain part of Croatia named Zagoria, many castles were ruined.

The circle, where the earthquake caused the heaviest losses has approximately the following bounds:—South-west, Karlstadt; west, Landstrass, Gurkfeld; north-north west, Rohitsch; north, Warasdin, Csáktornya; north-east, Kaproncza (Kopreinitz); east, Belovár; south-east, Sziszek, which corresponds to a territory of about 120 square miles; the centre of this circle was the place where the first shock emanated from. The data kept in the surrounding parts relative to the direction and the greatest intensity of the shock indicate the territory which lies to south-east from Agram, and forms the alluvium of the River Save as the starting-point of the whole phenomenon. Here the crevice in the earth appeared also, caused by the strongly-oscillated motion. A little to the east from the village of Resnik (east-south-east from Agram) was the crevice in the alluvium of the Save. It was 5 kilometres long, and had several interruptions, and extended in a south-east direction, from which here and there some smaller crevices radiated. This chief crevice, which continued through the Save as far as the village of Scitarjevo, showed in some places a few days after the earthquake openings one to two feet broad, but for the most part the crevice was filled with bluish alluvial sand, which was forced out, mixed with water by the opening and closing of the crevice being formed by the oscillation of the soil, the water forcing its way through this dense pulp, produced by its upheaval those small flat craters which many people are inclined to declare volcanoes of mud. The dimension of these small craters is very variable; their diameters differ between 2 and 75 c.m., their height 1 to 30 c.m.; and, calculating from these numbers the cubic contents of the largest flat cone, we receive nearly 0.5 cubic metres; this little quantity of the out-pressed material is enough to exclude the hypothesis that these cones were the result "of a slow action for some hours." If hydro-sulphuric gas was present during this phenomenon, as some believe, it is not known, because we want positive and trusty evidence on this point. Moreover it is not impossible that there should be an appearance of small quantities of hydrosulphuric gas dissolved in the water of an alluvial slimy soil, because such water generally contains decaying substances and finely-dispersed sulphates, but one can in no case suppose that a great quantity of hydrosulphuric gas would have produced the crevices and ejected the sand mixed with water.

Beyond this territory of 120 square miles the earthquake

was felt with a gradually diminishing strength, and in many places the motion was so weak that a great many of the inhabitants did not remark it. Among these can be mentioned Fiume, where they felt only a very slight shock; then Budapest and Vienna, where only one or two became attentive to this phenomenon.

Beyond the territory of 120 square miles, where they suffered the strongest shocks, there are yet some environs, though far enough from the centre, where destruction also happened, for instance in Styria, and in Hungary, in the neighbourhood of Pécs (Fünfkirchen). To explain the connection of these cases with the entire phenomenon deeper researches must be made.

It remains to communicate shortly the statics of the earthquake.

1. November 9, at 7h. 33m. 53s. in the morning, the first shock enduring 10 seconds with a subterranean noise. This one has caused all the damage.

2. November 9, at 7h. 37m. in the morning: an oscillatory motion without a noise.

3. November 9, at 8h. 27m. 55s. in the morning: slight motion.

4. November 9, at 10h. 50m. in the evening: very slight motion.

5. November 10, at 6h. in the morning: very slight motion.

6. November 11, at 11h. 26m. in the forenoon: a strong oscillation, which effected some damage.

7. November 16, at 12h. 4m. in the morning: a sufficiently strong shock accompanied with a dull noise.

8. November 16, at 12h. 44m.

9. " " 12h. 49m.

10. " " 1h. 9m.

11. " " 4h. 24m.

} in the morning:

weak oscillations, of which only the last had a little more strength than the others.

So it lasted continually during December. Even in this year (1881) in January and February feeble shocks recurred after longer interruptions; the last shock was recorded in the newspapers from March 4

Budapest, March 18

THE ST. PETERSBURG DYNAMITE MINE

THE following account of the mine recently discovered in St. Petersburg, extracted from Russian sources, gives a remarkable picture of the state of society in the empire, where able chemists and expert miners can be found to engage in such desperate undertakings.

It appears from a sketch-plan which accompanied the translation put into our hands, that the mine extended from one side of Malaya Sadobaya Street to the centre of the roadway; the total length of the mine gallery being fifteen paces, the street must be thirty paces, say seventy-five feet wide.

The gallery terminated in a chamber about double its diameter, and in this was found the charge contained in a case twenty-two inches long and eight inches diameter, weighing sixty-five pounds, and beside this a glass jar contained about thirty pounds more of the explosive substance, apparently an excess quantity over that required for the actual explosion. The explosive consisted of a species of dynamite made by mixing nitro-glycerine with powdered charcoal. This is more powerful in its effects than the ordinary substance, in which an inert body, generally a soft infusorial earth, takes the place of the charcoal. The description of the fuse, as contained in the Russian account, is very obscure, but so far as can be made out it would appear to have consisted of a wide heavy glass tube containing an explosive, described some time back in NATURE, and prepared by mixing nitro-glycerine with about 10 per cent. of gun-cotton, the result being a very explosive substance of a partially gelatinous character. In the midst of this, and

surrounded by a mixture of potassic chlorate and antimonious sulphide, was a sealed glass tube containing concentrated sulphuric acid and a leaden weight. The whole was then apparently connected with the dynamite in the case by means of an india-rubber tube also containing explosives. If this was the actual construction the *modus operandi* of the conspirators was very simple, for the heavy glass tube had only to be allowed to fall, when the lead would have broken the sulphuric acid tube, and the chlorate mixture would have at once inflamed, and the explosion of the jelly would have communicated by means of the rubber tube with the torpedo. At the same time it is very difficult to imagine the reasons which could have induced the conspirators to adopt so crude a method when, as it appears from the account, they had at their disposal in the room adjoining that from which the mine was driven no less than four galvanic batteries, with which the explosion could have easily been instantaneously effected by those on the watch for the passage of the intended victims, a method of operation much more consonant with the skilled character of the other parts of the work. It is however very difficult to understand a description such as this when derived from a non-scientific source, as may be imagined when one of our daily contemporaries stated that the fuse contained "*bartholley salts*," and another "chlorate of potash and sulphide of ammonium."

Whatever may have been the real mode intended to have been used by the conspirators, the results would have been sufficiently frightful, as it is probable that the charge found would have made a "crater" of about fifty feet in diameter.

The jelly contained in the glass tube was, when analysed, found to contain about 4 per cent. of camphor. This was added to render the mass less sensitive to any accidental shock which it might incur, and is an ingenious application of principles laid down by Abel (*Proc. Roy. Soc.* xxii. p. 163) in his well-known paper on "The History of Explosive Compounds," in which, though not actually mentioning the dilution of a liquid or semi-liquid explosive by the solution in it of another body, he clearly indicates the probable effects of such a treatment. That men of education and ability should so apply their undoubted powers must be a matter of regret to every student of science.

FISH-CULTURE IN THE UNITED STATES

IT is a common saying that everything in America is on a larger scale than in this country. The longest rivers, the largest lakes, the highest mountains, the broadest plains, the most stupendous waterfalls, and the biggest hotels, are all to be found in the New World. Fortunes are made with a rapidity which is unparalleled in Europe; and men who only lately were penniless adventurers are losing or winning millions in New York. The latest example of the scale on which everything in America is conducted may be found in a volume of more than 1000 pages, printed in the Government printing-office, bound in the Government "bindery" of the United States, and containing the Annual Report of the United States Commission on Fish and Fisheries. The volume, it may be added, has been preceded by five others of almost equal length; and gives a remarkable idea of the importance which the Americans attach to fish-culture.

It would obviously be impossible to attempt, within the compass of a newspaper article, any adequate review of a work of this character. But we may perhaps indicate its nature by rapidly describing its contents. The volume, then, is roughly divisible into two parts. The first 64 pages contain the Report of the Commission; the last 988 pages are occupied with appendices and an index. Forty-four appendices of unequal importance are thus pub-

lished. The greater portion of them consists of translations or reproductions of papers published in other countries and having more or less reference to the work of the Commission. For instance, there is a report by Herr Wallem (the well-known Norwegian Inspector of Fisheries) on the American Fisheries; by Prof. Sars on the Norwegian Deep-sea Expedition of 1878; by Mr. Stirling of Edinburgh on the Recent Outbreak of Salmon Disease; and by other authorities on various subjects. In addition the appendices contain original papers by Messrs. Livingston Stone, C. G. Atkins, and other American fish-culturists on matters more or less connected with fish-culture in the United States. Thus the volume undoubtedly contains a vast mass of information. Much of it indeed is written in a style which in this country would be considered more suitable to a review than to an official report. But the American system of government is so different from our own that an Englishman cannot easily form an impartial opinion on this point.

Herr Wallem estimates the yearly profit, by which we think he means the gross yield, of the fisheries of the United States at 27,300,000 dollars. In this sum is "naturally not included what foreign nations capture on the banks of America, nor what the fisheries of Canada yield. If one should take both these factors into the calculation the amount mentioned may perhaps be increased by one half, because the French fisheries alone on the Newfoundland Islands have a yearly profit of \$1,365,000 to \$1,638,000, and the Canadian fisheries yield \$10,920,000 to \$12,285,000 yearly." Herr Wallem adds in a note that "for comparison it may perhaps be instructive to state that the Norwegian Marine Fisheries may be estimated at \$12,285,000 to \$13,650,000 yearly, and the French at \$15,015,000 to \$16,380,000." If these figures may be accepted as correct on the high authority of Herr Wallem, the American fisheries must be worth about 5,500,000% a year; the French fisheries 3,250,000%; the Norwegian fisheries 2,600,000%; and the Canadian fisheries 2,250,000%. We have unfortunately no statistics at our command which would enable us to compare these values with the produce of our own fisheries, but we do not believe that any competent authority would place their value at less than 6,300,000%; and we believe that most persons would be disposed to name a higher sum. Englishmen, therefore, may have the satisfaction of reflecting that the fisheries of the British Islands are still the most important in the world; though the fishermen of the United States are fast overtaking British fishermen.

Those persons who are most familiar with the British fisheries are aware that for years past complaints have been made of the injury done both to fish and fishermen by the operations of trawling. It is very singular that trawling is also objected to in the United States; and the Commissioners print in their appendices a petition from the fishermen of Block Island on the subject. But the similarity between the complaints disappears on examination. A trawl in England is a large purse-net, attached to a heavy beam raised upon trawl heads or irons at either end, and dragged along the bottom of the sea. A trawl in Scotland is simply a draft or seine-net; a trawl in America is a long line baited with hooks and left on the bottom of the sea. It is very odd that these three distinct modes of fishing are all objected to in the different countries in which they are employed. In Scotland the drift-net fishermen object to the trawl or seine-nets; in England the drift-net fishermen and the line fishermen object to the beam trawls. In America the hand-line fishermen object to the set-line fishermen, whom they call trawlers. Among the fishermen of the three countries there is a cry against trawling, and the fishermen of the three countries are all alluding to distinct modes of fishing. These complaints may, centuries