shales and mudstones, but contain a group of volcanic tuffs on the horizon of the pisolitic ironstone.

The Carboniferous rocks appear to be about 700 feet thick, and contain conglomerates, sandstones, and shales, with plant-remains about the middle of the series.

The glacial striæ sweep round from SSW. at the north, to S.W. and WSW. at the south end of the district. In the Penmon area there is cross-hatching with a series running SSE., and it is suggested that this is due to fluctuations in the power of the Carnarvonshire glaciers to deflect the ice coming from the north, combined with the local influence of certain high ground.

3. "Seismic Phenomena in the British Empire." By M. F. de Montessus de Ballore, Captain of Fortress Artillery at Belle-Île-en-Mer. (Translated by L. L. Belinfante, B.Sc., B. ès L. Communicated by Sir Archibald Geikie, D.Sc., F.R.S.)

The author gives a brief outline of a plan that he has elaborated for studying Seismology. He has separated his work into four parts—I. The formation of an Earthquake Catalogue. 2. Refutation of the empirical laws previously enunciated. 3. Description of the globe from a seismological point of view. 4. Investigation of the characters which differentiate stable from unstable regions.

He gives a method by which the relative *seismicity* (or instability as regards earthquakes) of regions may be obtained and registered, and indicates some of the results which he has derived from his study, including the intimate relationship between instability and surface-relief, and the independence of seismic and volcanic phenomena.

The main part of the paper is a section of the third division of the author's work, and deals in detail with the earthquakes of the British Empire. In this part of the paper, the recorded earthquakes of the British Isles, India, Australia and New Zealand, British Africa, Canada, and various scattered possessions are described.

CORRESPONDENCE.

EOCENE BEDS AT BINCOMBE, DORSET.

Sir,—In your last issue (p. 247) Mr. Fisher says that if I had seen the section of Eocene beds at Bincombe open as he did, I might not have been at a loss to find room for the full thickness of chalk below them. But though I did not see the section, I had seen what was next best to it, and that was Mr. Fisher's account of it, showing the Eocene to be vertical. The chalk also is almost certainly vertical, or nearly so, between the Eocene and the mouth of the tunnel, where we are close to its base, but even so I was not able to pack in its full thickness, and had therefore to assume an overlap by the Eocene.

Mr. Fisher explains the occurrence of the Eocene gravels on the theory that they are wedged into the chalk by two faults, and do not occur as an outlier in the usual sense of the word. This

explanation involves certain difficulties. The shape of the outlier, as I still think it must be called, is roughly oval; the mass dropped in would therefore be cone-shaped. If it were a case of piping, which I do not think it is, this might be intelligible, but it is difficult to conceive a fault taking such a form. Nor is the difficulty lessened by the occurrence of several other small outliers in the immediate neighbourhood.

The structure seemed to me to be the same as that of the narrow strip of Tertiary beds near Lulworth, as Mr. Fisher suggests, except in one detail. In both cases the chalk, after running horizontally, or even dipping gently southwards, turns abruptly up so as to dip at 80° or more northwards; and in both, Tertiary beds, reposing naturally upon the Chalk, have shared in the flexure, and have been preserved from denudation in the elbow of the fold. But while at Lulworth the Isle of Purbeck fault coincides with the abrupt upturn of the strata, and thus runs between nearly horizontal Chalk and Eocene and nearly vertical Chalk, at Bincombe the Ridgeway fault runs at the base of the Chalk, and between it and Oxford Clay. I was not able to find any faulting there between the Chalk and the Eocene. That the abrupt upturn traverses the Bincombe outlier, we know by the fact that the gravels composing it are partly vertical, as shown by Mr. Fisher, and partly gently inclined, as proved by an exposure close to the western end of the outlier, where the chalk dips at only 15°. I quite agree with Mr. Fisher that in passing from south to north he is reading an ascending section in the Eocene strata.

A. Strahan.

Cardiff, 8*th June*, 1896.

THE AYRSHIRE "SHELL-BEDS."

Sir,—Many of your readers have doubtless been interested by Mr. John Smith's letter in your last number regarding his discovery of "interglacial shell-beds" at various heights in Ayrshire. Mr. Smith also read a paper on the subject at a recent meeting of the Geological Society of Glasgow.

While fully acknowledging Mr. Smith's great industry and perseverance in tracing out these "shell-beds," I would ask leave through your columns to repeat a *caveat* which I ventured to express at the meeting referred to, viz., against assuming offhand that the deposits are necessarily "interglacial," or true marine deposits *in situ*. It appears to me that there are many hints and indications that they may be accounted for in another way, and that it will require further prolonged and careful observations before we can pronounce upon them with any certainty. There can be no doubt, to begin with, that the Clyde ice extended in great force over the lowlands of Ayrshire up to the feet of the Galston and Muirkirk Hills. Boulders of West Highland schists are found plentifully as far up as the neighbourhood of Loudon Hill, and in similar localities. The abundant deposits of sand, gravel, and silt in some of the side-valleys are just what might be expected in these circumstances. The crushed and fragmentary condition of the shells, or very many