ed, so much so that the work of quarrying the limestone is greatly assisted by the jointed structure of the rock. Faults differ from joints in that, whilst the strata in the latter are still in relative position on each side of the joint, they have in the former slipped out of place. In such a case the continuation of a stratum on the opposite side of a fault will be found to be depressed, perhaps a thousand feet or more. It will be seen at once how that, in sinking a new shaft into a coal seam the possibility of an unknown fault has to be brought into consideration, since the position of the seam may prove to have been depressed to such an extent as to cause it to be beyond workable depth. Many seams, on the other hand, which would have remained altogether out of reach of mining operations have been brought within workable depth by a series of step faults, this being a term applied to a series of parallel faults, in none of which the amount of down-throw is great.

The amount of the down-throw, or the slipping-down of the beds, is measured, vertically, from the point of disappearance of a layer to an imaginary continuation of the same layer from where it again appears beyond the fault. The plane of a fault is usually more or less inclined, the amount of the inclination being known as the 'hade' of the fault, and it is a remarkable characteristic of faults that, as a general rule, they hade to the down-throw. This will be more clearly understood when it is explained that, by its action, a seam of coal, which is subject to numerous faults, can never be pierced more than once by one and the same boring. In mountainous districts, however, there are occasions when the hade is to the up-throw, and this kind of fault is known as an 'inverted fault.'

Lines of faults extend sometimes for hundreds of miles. The great Pennine Fault of England is 130 miles long, and others extend for much greater distances. The surfaces on both sides of a fault are often smooth and highly polished by the movement which has taken place in the strata. They then show the phenomenon known as 'slicken-sides'. Many faults have become filled with crystalline minerals in the form of veins of ore, deposited by infiltrating waters percolating through the natural fissures.

In considering the formation and structure of the better known coal-bearing beds of the carboniferous age, we must not lose sight of the fact that important beds of coal also occur in strata of much more recent date. There are important coal beds in India of Permian age. There are coal-beds of Liassic age in South Hungary and in Texas, and of Jurassic age in Virginia, as well as at Brora in Sutherlandshire; there are coals of Cretaceous age in Moravia, and valuable Miocene Teriary coals in Hungary and the Austrian Alps.

Again older than the true carboniferous age, are the Silurian anthracites of Co. Cavan, and certain Norwegian coals, whilst in New South Wales we are confronted with an assemblage of coal-bearing strata which extend apparently from the Devonian into Mesozoic times.

Still, the age we have considered more closely has an unrivalled right to the title, coal appearing there not merely as an occasional bed, but as a marked characteristic of the formation.

The types of animal life which are found in this formation are varied, and although naturally enough they do not excel in number, there are yet sufficient varieties to show probabilities of the existence of many with which we are unfamiliar. The highest forms yet found, show an advance as compared with those from earlier formations, and exhibit amphibian characteristics, intermediate between the two great classes of fishes and reptiles. Numerous specimens proper to the extinct order of 'labyrinthodontia' have been arranged into at least a score of genera, these having been drawn from the coal-measures of Newcastle, Edinburgh, Kilkenny, Saarbruck, Bavaria, Pennsylvania, and elsewhere. The 'Archegosaurus,' and the 'Anthracosaurus' are forms which appear to have existed in great numbers in the swamps and lakes of the age. The fish of the period belong almost entirely to the ancient orders of the ganoids and placoids. Of the ganoids, the great 'megalichthys Hibberti' ranges throughout the whole of the system. Wonderful accumulations of fish remains are found at the base of the system, in the bone-bed of the Bristol coal-field, as well as in a similar bed at Armagh. Many fishes were armed with powerful conical teeth, but the majority, like the existing Port Jackson shark, were possessed of massive palates, suited in some cases for crushing, and in others for cutting.

In the mountain limestone we see, of course, the predominance of marine types, encrinital remains forming the greater proportion of the mass. There are occasional plant remains which bear evidence of having drifted for some distance from the shore. But next to the 'encrinites', the corals are the most important and persistent. Corals of most beautiful forms and capable of giving polished marble like sections, are in abundance. Polyzoa are well represented, of which the lace-coral (tenestella) and screw-coral (archimedopora) are instances. Cephalopoda are represented by the orthoceras, sometimes five or six feet long, and goniatites, the forerunner of the familiar ammonite. Many species of brachiopods and lammellibranchs are met with. Lingula, most persistent throughout all geological time, is abundant in the coal shales, but not in the limestones. Aviculopecten is there abundant also. In the mountain limestone the last of the trilobites (Phillipsia) is found.

We have evidence of the existence in the forests of a variety of cehtipede, specimens having been found in the erect stump of a hollow tree, although the fossil is an extremely rare one. The same may be said of the only two species of land-snail which have been found connected with the coal forests, viz., pupa vetusta and zonites priscus, both discovered in the cliffs of Nova Scotia. These are sufficient to demonstrate that the fauna of the period had already reached a high stage of development. In the estuaries of the day, masses of a species of freshwater mussel (anthracosia) were in existence, and these have left their remains in the shape of extensive beds of shells. They are familiar to the miner as mussel-binds, and are as noticable a feature of this long ago period, as are the aggregations of mussels on every coast at the present day.

A MODEL MINE.

Scarcely had the State inspector emerged with the verdict "all's well" from the Marianna coal mine in Western Pennsylvania when an explosion wrecked the works and blotted out the lives of 158 of the 139 miners then in the shafts and galleries. The irony of the situation is increased by the fact that this particular mine was considered the model mine of America, if not of the world. Before it was built, we are told, the chief officers of the company made a tour of Great Britain, Belgium, Germany, and France to study mining methods in those countries, and they claim to have adopted every safety device and modern feature which could be applied under local conditions. "As compared with the ordinary mine, it was more like the subway life of a great city", says one account—the passa-