as aqueducts along the upper portions into which water would flow, must produce compact ice; and its power in that very action was quite adequate, by compression, not only to remove ice, but even mountains of earth, provided the *point d'appui* be afforded. It was evident with respect to the lower portions supporting Mount St. Elias, which were subject to a summer-heat which ripened strawberries, and was even more oppressive than we experienced in England, and to rapid thaws of the inferior levels, that repeated fracture and avalanches would occur, and that one must calculate on sudden and tremendous concussive force, by the breaking away of whole ranges and precipitating themselves on the lower strata. His opinion was that the shocks of the avalanches communicated laterally had produced such fractures as had been noticed in those peculiar pyramidal forms near Mount St. Elias. These fractures opened, were filled by water, which probably froze at night or when the sun was absent, and expansion drove the exterior masses, which were termed bergs, into the sea.

DURA DEN.

By the Rev. Dr. ANDERSON, F.G.S.

The Rev. Dr. Anderson stated that last year the Committee of the Association made laborious researches in quest of the long-lost *Pamphractus* of Agassiz, nowhere seen nor heard of in any part of the above-named rocks for a period of twenty-five years. He had now to state that in their latter excavations they had come upon the hidden treasures, and he had the pleasure of laying them upon the table, in a condition of the most perfect preservation. There was a double interest connected with this curious crustacean. First, of a rare discovery; and next, of a successful result in a matter of keen and important controversy. The specimens discovered were five impressions of the *Pamphractus Andersoni*, two of which were perfect in all their plates, whilst the others were more or less mutilated in some of their organisms. Besides this genus, the excavations had revealed at least one other entirely new to science. The specimen of this new fossil, which he laid upon the table, was in a sufficiently good state of preservation for determining all the true characteristics of the genus in scales, fins, plates, and general contour. The caudal and pectoral fins were enormously large, the body short and small, and the head comparatively very large.

SUBTERRANEAN MOVEMENTS.

By Prof. VAUGHAN, F.G.S.

Professor Vaughan, of Cincinnati, stated that the definite relations recently discovered between calorific and mechanical action seemed to have an important bearing on questions relating to the secular refrigeration of the earth and the high temperature of its internal regions, even at the present time. The vast amount of heat supposed to have escaped from our planet during past ages, might be reasonably expected to call into existence forces of much greater efficiency than those indicated by the upheaval of lands, or by the violence of earthquakes and mechanical eruptions. Our terrestrial fabric had a strength too limited for the full development of such great calorific powers by the

unequal contractions of its different parts; and in a cooling globe compound gases could not be expected to produce any decided mechanical effect, at least without materially altering the composition of the atmosphere. But, apart from these causes, the transition of the igneous rocks from a fluid to a solid state would be attended with occasional paroxysmal movement and change. Being dependent on hydrostatic conditions for stability, the different parts of the earth's crust must extend into the greater reservoir of lava to a depth in some measure proportionate to the elevation above its surface. Continents must rest on solid foundations far deeper than those which supported the body of the ocean; and the violence which subterranean forces manifested in several islands might be ascribed in part to the weakness of the barriers which restrained them. Inequalities in the solid envelope of our globe were indicated with some certainty by local forces of gravity. The anomalous character of the vibrations of the pendulum, when applied in some places, justified the conclusion that the invisible side of the earth's crust contained the greatest irregularities, and that our continental tracts of land rest on the bases of gigantic subterranean mountains, whose tops might be depressed even three or four hundred miles below the mean level of the solidified matter. The accumulations of solid matter on the internal mountains must ultimately be crushed by the strain which their augmented size occasioned; a mighty avalanche of rock would then tumble to the thinner part of the earth's crust. Regarding these masses as the cause of earthquakes, they might account for the instantaneous manner in which shocks of earthquakes occurred, their extreme violence, and destructive character near the coasts of continents and on adjacent islands, while they were almost imperceptible in the interior of continents. It was probable that the ascending movements of silica, and perhaps of other isolated matter, might serve to bring the heavy metallic deposits from the central to the superficial regions of our planet; and the general occurrence of gold in auriferous quartz-rock might thus admit of plausible explanation.

THE FORMATION OF LAND.

By the Rev. C. R. GORDON, M.A., F.R.S.

The Rev. C. R. Gordon, M.A., F.R.S., proceeded to say that the solid parts of the globe are in general composed of sand, gravel, argillaceous and calcareous strata, or of the various compositions of these with other substances. Calcareous bodies belong to the sea, and are formed in it. There are only two ways by which porous or spongy bodies can be consolidated, either by congelation or attrition. To procure solidity, it must be brought about by inducing fluidity, either immediately by the action of heat, or directly by the operation of a solution. Thus, fire and water may be considered as the general agents in this operation. The strata formed at the bottom of the sea are to be considered, therefore, as having been consolidated either by aqueous solution and crystallization, or by the effect of heat and fusion. We have strata consolidated by calcareous spar. We have strata made solid by fluor, a substance not soluble, so far as is known, by water. We have strata consolidated with sulphureous and bituminous substances, which do not correspond to the solution by water. We have strata consolidated with siliceous matter, in a state totally different from that under which it has been observed, on certain occasions, to be deposited by water, some consolidated by felspar, a substance indissoluble in water, some also consolidated by almost all the various metallic substances,