The specimens submitted by Mr. Bennie belong to the following species:—

MOLLUSCA.

Tellina calcarea *(proxima)*.	Leda pygmæa.
Mya truncata.	Skenea planorbis.
Leda pernula.	Littorina litorea.

CIRRHIPEDIA.

Balanus balanoides.

ENTOMOSTRACA.

Jonesia contorta.	Cythere latissima.

FORAMINIFERA.

Nonionina striato-punctata.	Quinqueloculina seminulum.

XLVIII. *On the* AURIFEROUS ROCKS *and* DRIFTS *of* VICTORIA. By Mr. WILLIAM CAMERON.

(Read January 11th, 1866.)

IN submitting to the Geological Society of Glasgow an account of the auriferous rocks and drifts of Victoria, I have to state at the outset that my opportunities of making myself practically acquainted with the peculiar habits of the precious metal, whether as developed in auriferous rocks or in alluvial deposits, have been both varied and extensive, and the statements of the following paper are nearly all the result of personal observation. Where I have departed from this rule, I have confined myself to the most reliable authorities, and I have to acknowledge my indebtedness for much information to Messrs. Geo. F. Ulrich and D'Oyley H. Aplin, of the Geological Survey of Victoria.

In the principal gold fields of Victoria, the rocks consist chiefly of thick bedded, fine grained sandstones, interstratified with belts of slate of Lower Silurian age. In the lower ranges the sandstones are generally soft and of a yellowish colour, interstratified with soft whitish argillaceous slates, whilst in the higher ranges, hard bluish-grey sandstones prevail. The slates are also indurated and of a darkish blue, and, in some localities, are admirably adapted for roofing purposes. In the Lower Silurian rocks of the gold-fields, fossils are not generally plentiful, although, in some belts of slate, Graptolites and Hymenocaris have been found in abundance. The

strike of these rocks is generally within a few degrees of north and south, and the prevailing dip is towards the west. The latter, however, varies much more than the former; the bedding and cleavage planes are often identical. Quartz reefs are very abundantly interspersed, and are nearly all more or less auriferous; the strike of these generally corresponds with that of the surrounding rocks, and cross lodes are rarely met with; and in this respect, I am informed, the mines of Victoria afford a contrast to those of Europe; the metamorphic slates are generally of a greenish grey colour, with a glossy striated surface full of greenish fahlunitic grains, and frequently valuable for quarrying purposes, splitting up into large regular slabs, which have been much used for paving.

In nearly all the Australian gold-fields, granite is to be found uptilting the Silurian rocks; the most prominent mass in the western gold districts is that extending between Mounts Macedon and Alexander, both prominent granite mountains, and trending west from these lie some of the principal gold fields. The granite of these ranges is generally of a coarse grain, and of a greyish white. Of its component parts, white or grey orthoclase is the most prominently developed, imparting to it frequently a porphyritic appearance; in some places, small crystals of black hornblende are found, and also small veins of quartz and red felspar. Along the ridges of the valleys the granite is harder and finer grained, and appears in large round masses. In the neighbourhood of Mount Alexander, some valuable quarries have been opened, and about twelve months ago a magnificent block, weighing over forty tons, was conveyed from thence to Melbourne by rail, for the monument of Burke and Wills, the explorers.

The auriferous drifts lie in the Older Pliocene, Newer Pliocene, and Post-Pliocene. The Older Pliocene exists generally in the form of cement-hills, extending along the banks of the water-courses or creeks; these hills consist of bands of conglomerate, round quartz and sandstone boulders and pebbles, firmly cemented together by hydrous oxide of iron, or decomposed felspar, and where these have occurred in successive layers there are frequently found distinct deposits of gold in each layer, hence what were called false bottoms often perplexed and deceived the early diggers. I have known some hills where these ferruginous cements were as much as twenty to thirty feet in thickness, and of a dense brown and almost bituminous appearance. These cements, besides presenting on their upper

surface, bottoms, whereon deposits of gold were left, often contain imbedded in them a considerable quantity of waterworn gold, the only way of extracting which is to crush the cement and subject it to the same treatment as quartz. I have crushed cement which yielded twenty ounces to the ton, the gold existing in flat pieces about the size of peas and beans, rounded at the edges. These cements are so hard and compact that they can only be mined with the aid of blasting powder. These hills generally overlie basin-like depressions in the Silurian rocks.

Round the flanks of the older hills lie deposits of Newer Pliocene, also highly auriferous, frequently containing large heavy nuggets. The Post-Pliocene deposits occupy the gullies and upper beds of the creeks. They consist of fragments of shale, sandstone, and angular quartz. In the creeks or in beds of deep valleys are found deposits of Newer Pliocene, covered by re-deposits of Post-Pliocene, and where this occurs there are deep sinkings. These drifts, fed in the first instance by tributary gullies, frequently extend for miles, and assume the character of river-beds, with well-defined banks and large rounded quartz boulders, the results of powerful aqueous action. When these contain gold they are called "leads." In some districts they are very rich, and from the great width and depth of their deposits, afford ample scope for the most extensive mining operations.

In regions where volcanic overflows have taken place, we find these drifts often overlapped by one or more layers of trap rock, as in the Coliban, Loddon, and Ballarat districts; in the latter, more especially, this has occurred. Here, beginning at the slopes of the Silurian ranges, the course of the gold may be traced, first appearing in shallow rifts and gullies, where the alluvial deposit varies in depth from six inches to as many feet. Further on we come to better defined veins or runs, where the sinking varies from twenty to fifty feet; these, in their turn, merge into deep leads, eighty to one hundred and twenty feet from the surface, assuming, as in the deeper deposits, a more defined character, until they disappear under a broad overlying belt of trap. Underneath these overflows of trap there are auriferous deposits of great breadth and thickness.

In this district the lodes appear to be much better defined than in any of the other gold fields, the slates and schists rising in abrupt ridges along their course, and thus more completely directing and

confining the run of the leads. Some idea of the wealth of the Ballarat mines may be formed from the fact that the mining reports show that eight of the principal deep lead companies of this district obtained in the aggregate nearly 12,000 ounces of gold during the month ending 21st October, 1865.*

On the banks of the Loddon and the Coliban, the trap overlies the Pliocene hills, and the rivers having worn their way down to the schists, leave along their banks an escarpment, shewing the whole series, basalt, drift, and Silurian rocks, and where this occurs, the plan of tunnelling is found to be a most efficacious and economical method of working. These are frequently covered by a deposit of angular quartz drift.

Of other alluvial mineral deposits besides those of gold, tin alone exists in any notable quantity, and it is chiefly in the Ovens district (the great eastern gold field of Victoria) that this occurs. It is found here in the form of black sand, which contains from sixty to seventy per cent. of pure tin, as also a small per centage of gold.

Diamonds, rubies, zircons, sapphires, and topazes have been found in the various drifts throughout the gold-fields, but from the ignorance and carelessness of the miners, many of these are thrown amongst the refuse, and none of any great size or value have as yet been discovered.

But gold, as found in the matrix, is far more interesting to the geologist, than as it is seen in alluvial deposits. The latter is governed by laws which are patent to all, and are, with slight variations, alike in all parts of the world where gold is to be found. Whilst of gold in the matrix comparatively little is known, every new fact brought to light in connection with operations in auriferous rocks, widens the field of speculation; and, by extending knowledge in reference to what has now become an important branch of industry, must have a practical and beneficial effect.

There can be little doubt that in Victoria, quartz, if not invariably, is, at least, generally the matrix in which gold is to be found. I have been told that it has been seen in granites, slates, and sandstones; but I have never known one instance of this, except when these rocks have been in close contact with, or have intruded upon, an auriferous quartz reef. I have frequently seen

* A recent return from one of the Victorian gold fields, mentions that 2400 tons of cement, from one mine, yielded 2800 ounces of gold.