The structure of this limestone, and also the microscopic cellular structure of the algae which are present in it, are described in detail by J. L. Wray.[12] Numerous deposits of phylloid algal limestone which are close enough to the surface to be exposed in road cuts and river banks are described by P. H. Heckel and J. M. Cocke.[13]

Algal Layer-built Rocks

Another type of algal limestone in which the effects of algal growth are readily visible is a certain laminated limestone which consists of stromatolites. Stromatolites are of various shapes, but the best known ones are rounded structures which are made up of thin layers of hardened sediments. In most cases each layer of the stromatolite was formed by a thin mat of fine, filamentous algae which collected sediments from the water. This is the same process by which the fossilized algal mats of sabkha deposits are formed, as described in Chapter 5. However, in the case of stromatolitic limestone, the mats form rounded or roughly spherical structures up to more than one foot in diameter. Figure 24 shows a photograph of one such structure, a stromatolite, in limestone of the Belt Series of Montana. The laminations which were produced by the successive generations of algal growth can be clearly seen in this and in many other beds of ancient stromatolites. Many of these are found in the United States, Canada, Europe, Asia, Africa, and Australia.[14]

These stromatolitic structures were largely a mystery to geologists of the earlier part of this century, but about 1930 biologists and sedimentary geologists made the exciting discovery that modern stromatolites are now in the process of growth on the coasts of islands in the Caribbean, and of the Persian Gulf and Australia.[15] During the last 15 years, many other places where these are currently being formed have been discovered, and the processes of their development have been studied in detail. In each case it is found that the stromatolites, and similar carbonate layered structures, develop only in shallow water or in the tidal zones where they are exposed intermittently.

The formation of stromatolites and related structures is basically a process of accumulation of calcium carbonate sediments on thin, growing mats of filamentous algae. There are numerous species of algae which have the ability to produce stromatolites by this process, most of them belonging to the group called blue-green algae. The majority of these do not secrete calcareous skeletons, as the encrusting red algae do, but instead, they form a sticky, mucilaginous layer over their surface. The sticky surface traps sediment grains which wash up over it as the tide comes in, and also traps small amounts of calcium carbonate particles which precipitate out of the water. After a thin coating of calcium carbonate sediments has accumulated, more algal filaments grow up over the coating, produce more mucilage, and collect another layer of carbonate sediment.[16] This process results eventually in the formation of thick beds of laminated calcium carbonate, which later lithifies to become hard limestone or dolostone.[17]