

red by dissolved iron-containing minerals which wash down over it from above. Thus when observed from a distance, this thick deposit of limestone has the appearance of a red wall, instead of the natural gray color of most limestone. This deposit is over 700 feet thick in some places along the canyon, and lies at a depth of nearly 2,000 feet below the present surface (canyon rim) at some points.<sup>22</sup> The Redwall Limestone is classified as belonging to the Mississippian geological Period. Figure 26 shows its position in the local stratigraphic column in the Grand Canyon.

This great formation of limestone contains several types of typical marine carbonate rock, and gives a clear record of the way by which many of its parts were formed. The composition and texture of many of the Redwall strata show that biological processes were important in their deposition, and that they were formed naturally in relatively calm seas. The characteristics of the Redwall Formation provide us with an opportunity to note some of the practical uses of a knowledge of limestone. Prior to the time when sedimentologists, paleontologists, and biologists had acquired an understanding of limestone formation processes, a mass of limestone such as this was largely a mystery. Now, what was a mystery has become highly meaningful, and has aided greatly in understanding the history of the Grand Canyon area, as well as of other sedimentary deposits of the earth.

We have stated that the Redwall Limestone contains a clear record of the processes by which it was formed. Perhaps some observers who are unfamiliar with sedimentology may not recognize these features when casually examining the walls of the Grand Canyon, but the identifying characteristics are nevertheless present. When we begin to study rock samples from this formation we will soon notice that many of them have a high proportion of readily identifiable components such as are found in the sediments of the Bahama Banks. These include both fine and coarse skeletal particles from animals and calcareous algae, ooids, and various kinds of pellets. There are also fossilized algal mats, which show that they had trapped fine particles of lime mud, as they do today.<sup>23</sup> This and other features of the distribution of the very fine lime-mud particles are convincing evidence that the waters were relatively quiet during a significant part of the time that the Redwall Formation was being deposited. Also, the presence of a high proportion of biologically formed components shows that the formation is not a product of mere inorganic precipitation.

One of the most striking characteristics of this formation of limestone is its high degree of purity, coupled with the great thickness and broad geographic extent of the deposit. (The Redwall Formation extends for over 175 miles from north to south, and for more than 275 miles from east to west.) In some of the parts which lie to the south of the Grand Canyon region, appreciable amounts of quartz sand are present; but in most other places this formation is almost pure calcium carbonate and calcium-magnesium carbonate. In many parts of the Canyon the amount of foreign matter present is much less than one percent.<sup>24</sup> Here then is abundant testimony