MICROFAUNAL TECHNIQUE IN THE STUDY OF OLDER PALEOZOICS

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The correlation of older Paleozoic rocks has been found in many cases to be difficult on account of the scarcity of fossils. This may be due to the fact that conditions were antagonistic to life during the deposition of the sediments or at least to the preservation of fossils, or it may be due to changes which have taken place in the rock since deposition. Since it has been found to be a somewhat general rule that the more ancient rocks are the most altered, it is not surprising that the older Paleozoics in some areas are essentially devoid of fossils.

The term "non-fossiliferous," however, has been applied in too many cases to those rocks having no megascopic fossils, and the possibility of the presence of microscopic forms in many such rocks has been overlooked. Furthermore the microfauna of a limestone is likely to be destroyed in any alteration process unless some unusual character prevents it. Were we to look for animals with such an unusual character, the arenaceous foraminifera would seem to offer the most promising possibilities. These animals have tests composed of cemented sand grains or other foreign objects, and, no matter what the cementing material was originally, it is found to have been silicified in most cases or at least altered to such an extent that the tests are now more difficult to break down than the surrounding rock matrix.

A technique for breaking down both altered and unaltered rocks without also destroying these foraminifera is now needed. This paper discusses only those processes by which limestones have been broken down. The limestones examined ranged from high-calcium types to those which were true dolomites. Since even a small amount of effervescence will destroy the more fragile foraminifera, the greatest care must be taken with all types of limestones to prevent the destruction of these forms. The presence of broken down tests can be detected by fragments in the pan after screening.

The most important step in the process, then, is the determination of the correct strength of acid to be used for the given type of limestone. When there is only a small sample to work with even one mistake may destroy all available material. A safe method is to place the sample, which has been thoroughly washed, in a beaker or large tumbler and add water until the container is three-fourths full. There should be at least ten times as much water as the space occupied by the sample and even a greater proportion of water is desirable. Hydrochloric acid is added very slowly. The C. P. grade has been found to give much better results since the commercial grade will often cause a harmful precipitate of gypsum. A strength of forty parts water to one part acid is, in many cases sufficient. After adding a small amount of acid it is best to wait a few minutes until the temperature of the solution rises, since this rise in temperature aids in the breaking down process and must be taken into consideration.

If the sample that is being examined is limited in amount, greatest care must be used to prevent the destruction of the specimens that have been freed from the matrix. When raw acid is poured into the beaker it sinks to the bottom and the unprotected specimens are bathed with strong acid which in most cases is strong enough to break them down. This necessitates washing the residue after the action of the acid has ceased and before any fresh acid is added. The part of the sample that has not been reduced is carefully lifted out. If it is to be further reduced, it may be placed in a second beaker and the surplus liquid poured onto it. The residue is then carefully washed into an evaporating dish. The strong current from a faucet should not be allowed to strike the residue. A slow process of washing and decanting should be employed until the water is perfectly clear. All the water is poured off with the exception of a sufficient amount to wash out the residue onto a square of paper. Ordinary newspaper has been found to give better results in this drying process than a harder or rougher paper. The wet residue will stick to the newspaper and the surplus water can then be poured off. If the paper is too rough, as is the case, for example, with paper toweling, the dry residue cannot be removed without breaking the specimens.

A convenient method of drying indoors is over a radiator. A table just high enough to stand above the radiator is placed over it, and the part of the table directly over the radiator is replaced with wire screen. A number of papers may be placed on this screen and dried as slowly as desired. A portable electric heater also may be used successfully in this process. Drying over a fire is dangerous, for, if the water in the foraminifera is heated it will soon destroy them.

Residues from very weak acid solutions will often also contain silicified and chitinous fossils such as ostracods, sponge spicules, small corals and brachiopods, conodonts, scolecodonts, and many other forms that should be of interest to paleontologist and stratigrapher.

Since the method followed here destroys the calcareous microfauna in the limestone, it is probable that in many cases the faunal lists would be greatly increased by the development of a technique for the study of the calcareous forms. Although thin sections have not shown the presence of calcareous foraminifera, they have shown that other calcareous forms are very abundant in some samples.

The finding of an abundant foraminiferal fauna in the Silurian rocks of the Mississippi Basin certainly indicates that an important method of correlation has long been overlooked, and that now an entirely new field of study is opened to the geologist who is interested in the correlation of the older Paleozoics.