

Exercise 5

Biostratigraphy

Biostratigraphy is the subdiscipline of geology that is concerned with determining the relative ages of sedimentary rocks on the basis of their contained fossils. The practical application of biostratigraphy is **biostratigraphic correlation**: i.e., establishing the temporal equivalence of widely separate rock units on the basis of fossils.

Fossils are useful in relative age determination because the processes of evolution have produced a unique sequence of life forms through time. Every species of fossil plant, animal and protist has a definite **stratigraphic range**, the range in geologic time from its evolutionary origin to its extinction. Similarly, every interval of geologic time has been characterized by its own distinctive faunas and floras.

The age of a fossil-bearing sedimentary rock can be determined if the stratigraphic ranges of its contained fossils are known. For example, suppose that a particular trilobite species is known to have lived in late Cambrian time. It follows that any rock containing fossils of that particular trilobite must be late Cambrian in age. In practice, determining the precise stratigraphic ranges of fossil species can be quite involved. Nevertheless, the stratigraphic ranges of thousands of species are well known, and they can be used to correlate rocks with a precision that generally exceeds that of radiometric dating.

Part 1

Before fossils can be used to help determine the relative age of a sedimentary rock, their stratigraphic ranges must be known. The following exercise is a simplified example of how one might go about documenting the stratigraphic ranges of some fossil species in rocks of known ages, and then using that information to infer the ages of rocks in previously unexplored areas.

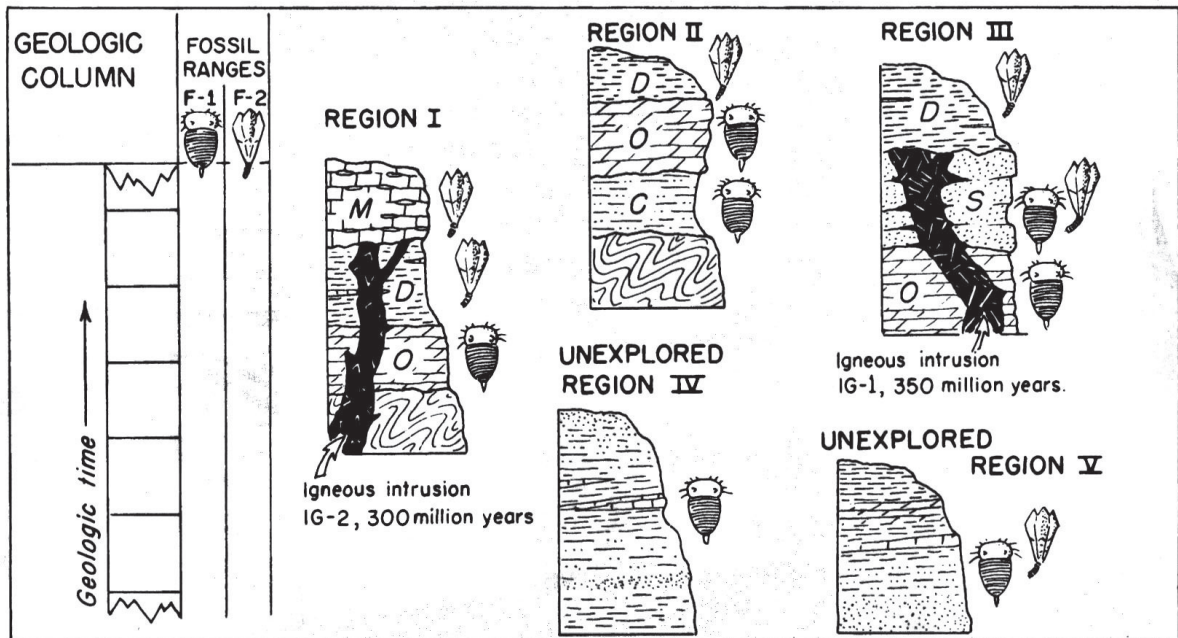


Figure 1—Occurrences of two fossil species at five separate localities. Ages of rocks in regions I, II, and III are known on the basis of independent evidence. Ages of rocks in regions IV and V must be determined on the basis of their contained fossils. Abbreviations: C = Cambrian; O = Ordovician; S = Silurian; D = Devonian; M = Mississippian (from Brice et al. 2001).

- Use letter abbreviations to complete the geologic column at the left in Figure 1, with Cambrian at the bottom and Mississippian at the top.
- Now, with your knowledge of the geologic time scale and the Principle of Superposition, use heavy vertical lines to show the stratigraphic ranges of species F-1 and F-2 in the two columns under the heading "Fossil Ranges." You can determine the stratigraphic ranges of these species by observing their occurrences in rocks of known ages in regions I, II and III.
- Using the stratigraphic ranges of species F-1 and F-2, what inference can you make about the age of the fossil-bearing layers in region IV?
- What inference can you make about the age of fossil-bearing strata in region V?