c10 Through-going disturbance of beds < infaunal trace fossils, Mn nodules>

Go to the ant thou sluggard; consider her ways, and be wise.—E. O. Wilson quotes *Proverbs* 6:6.[3]

Ants are the most abundant of insects, the most effective predators of other insects, and the busiest scavengers of small dead animals. They transport the seeds of thousands of plant species, and they turn and enrich more soil than earthworms [***Footnote c10.1***]. In totality (they number roughly in the million billions and weigh about as much as all of humanity), they are among the key players of Earth's terrestrial environment. Of equal general interest, they have attained their dominion by means of the most advanced social organization known among animals.

—E. O. Wilson [4] (who, Michael Ruse notes, "interpreted what he saw with the metaphor of a division of labor. ... but ants are not humans and so do not suffer from boredom.")[5]

Edward Osborne Wilson (1929-) discovered how ants communicate by producing pheromones. He is best known for his *Sociobiology: The New Synthesis*, 1975, in which he gives Darwinian explanations of social behavior from ants to humans. He is an advocate of the species is a master-piece of evolution, offering a need to preserve biodiversity: "Each vast source of useful scientific knowledge because it is so thoroughly adapted to the environment in which it lives. Species alive today are thousands to millions of years old. Their genes, having been tested by adversity over so many generations, engineer a staggeringly complex array of biochemical devices to aid the survival and reproduction of the organisms carrying them."[6]

Sediments that are stiff can preserve burrows where these have been backfilled by the burrowing animal or have been infilled by minerals or other sediments. Such evidences of past life are called *trace fossils*. (*Note*: Preserved parts of an organism are called *body fossils*.) The study of plant and animal fossil traces for the existence and life-style information (habits, activities) contained is called *ichnology* (Gk. *ichnos*, track). Specialists in this field are called *ichnologists*.[7]

Marine trace-fossils have been much studied by oil geologists who use them to know paleoslopes up which oil can have migrated.[8] For example, intertidal zones, where nutrients run deep into sediments, have burrows that are mostly vertical, whereas on continental slopes in deeper water, the burrows are shallower, more often horizontal, and become less frequent with increasing depth until, in the deep ocean, marks made by animals are relatively few and are confined to bedding surfaces.

The massive (unbedded) texture of some marine sedimentary rocks, such as chalk, that originate as ooze can be due to bioturbation (stirring by the activity of animals that move about in the upper part of an accumulating sediment to feed). Deepsea manganese nodules are kept at the surface of the seafloor by bioturbation (***Footnote c10.2***).[9]

Nonmarine trace fossils of commonly fossilized burrowing vertebrate animals are rare. By contrast, the trace fossils (trails, tunnels, nests, and burrows) of rarely fossilized land invertebrates are abundantly common. However, for geological stratigraphy their value is not great as these trace fossils typically show stasis in evolution over vast lengths of time. Termite nests, the size and shape of baseballs and with spiral ramps inside, in South American rain forests are no different from trace fossil nests 65 million years old that have been found north of Gallup, Utah. Ant nests 150 million years old are so similar to modern chamber and corridor ant nest burrows that they can be distinguished from termite nests: the ants reinforce hollows by compacting the sides with their heads used as hammers whereas the termites reinforce hollows by lining the sides with homemade concrete. Freshwater-crayfish burrows today are essentially the same as those made 200 million years ago.

The earliest evidences of multicellular animal life (metazoa) are traces made before 555.3 ± 0.3 million years ago (in the Neoproterozoic) by the triploblastic bilaterian *Kimberella*.[10] ❑