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Study on the Cambrian Explosion based on the diversification of trace fossils.

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In order to clarify whether the Early Cambrian biotic evolution represented by trace fossils was really an "explosion", trace fossils in the Early Cambrian Chapel Island Formation in the Burin peninsula, Newfoundland, Canada and the Middle Cambrian Strata in the Clarks Fork Canyon, Wyoming, USA were comparatively studied. Special attention was paid to the diversity of trace fossils and their sizes, densities and their stratigraphic changes. Among various trace fossils, Planolites was used for investigating the sizes and their distributions.

In the Earliest Cambrian (Treptichnus pedum Zone), increase of trace fossils was observed immediately after the PC-C boundary, and also in the uppermost part of T. pedum Zone near the following R. avalonensis Zone. Although the lower to the middle part of T. pedum zone was composed of two facies (GC facies and SiS-D facies (Myrow 1992)) which were thought to have deposited in difference environments, there was almost no major difference in the trace fossil assemblages between these two facies. It suggests that the original trace fossil assemblages characteristic to the each environment did not develop at that time.

The range of size distribution about burrow diameters was narrow in the T. pedum Zone. Burrow diameters were dominantly small (1~2mm). On the other hand, the range became broader in the following R. avalonensis Zone. To compare the results with that of the Middle Cambrian, the animals which created various sizes of Planolites appeared in the early stage of the Lower Cambrian between T. pedum Zone and R. avalonensis Zone. Besides, it is indicated that the bedding became heavily bioturbated in the R. avalonensis Zone from the result of trace fossil density. The level of bedding plane bioturbation in the R. avalonensis Zone is almost comparable with that of the Middle Cambrian formation.

Though intense bioturbation is observed in the Early Cambrian and the Middle Cambrian, microbial mat structures are observed in both the Early Cambrian and the Middle Cambrian formations. Such occurrence of microbial mat suggests that the dramatic bioturbation called "agronomic revolution" did not always occur in the Early Cambrian and the Middle Cambrian; there were many times when the biological activity weakened. The horizontal trace fossils occurred on the surface of the microbial mat structures in the Middle Cambrian, although it was seldom shown in the Early Cambrian Chapel Island Formation. This may suggest that there appeared a new type of trace producers on the mat in the Middle Cambrian.

Keywords: Early Cambrian, trace fossil, diversification