REVISING THE RHOMBIFERAN RADIATION: A NEW LOOK AT MORPHOLOGY, DIVERSITY, PHYLOGENY, AND PALEOECOLOGY

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Glyptocystitid rhombiferans had the second largest radiation among echinoderms in the Early and Middle Ordovician as part of the crinoid-rhombiferan component of the Paleozoic Evolutionary Fauna. These rhombiferans first appeared just above the Cambro-Ordovician boundary and produced a medium-sized radiation with 17 genera in the Early Ordovician and at least 20 genera in the Middle Ordovician. This was apparently the high point of rhombiferan diversity, and they then occupied many soft-substrate environments both offshore (where the group may have originated) and onshore. Most rhombiferans occur in Laurentia, Baltica, and northern Gondwana (central and southern Europe), and only a few specimens are known from other areas such as southwest Gondwana (southern Mexico and Bolivia), southeast Gondwana (Australia), and China. Recent collecting in the western United States has indicated that the Early Ordovician radiation of rhombiferans produced many genera having alternate types of exothecal respiratory structures plus a few having pectinirhombs, followed by a larger Middle Ordovician radiation of rhombiferans mostly having standardized respiratory pectinirhombs. Therefore, pectinirhombs cannot be used as the key or defining character to diagnose glyptocystitid rhombiferans. A cladistic analysis of selected rhombiferan taxa using PAUP 3.1 indicates that nearly all the early non-pectinirhomb genera branch off together in the lower part of the tree without regard to number of plates around the periproct, but higher pectinirhomb-bearing clades are diagnosed by this feature. This means that number of plates around the periproct must be used in congruence with other characters for reconstructing rhombiferan phylogeny.

One of the major innovations developed by rhombiferans was their enlarged, highly-flexible, proximal stem leading to a long, thin, apparently unattached, distal stem. This distinctive two-part stem has been interpreted differently by each of us (perhaps not all mutually exclusive), from a slightly flexible wriggling structure for gliding along the sea floor, or a nearly stiff bracing structure for pushing along the substrate, to an openly coiled support structure to allow upright feeding in cylindrical forms.