The effect of preservation on diversity in a Triassic reef basin assemblage

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Taphonomic effects complicate the assessment of variations in biodiversity over time. Most pre-Cenozoic fossil assemblages have been altered through taphonomic effects, such as lithification and aragonite dissolution. Several studies have found alpha (local) and gamma (global) diversity in marine ecosystems to be low in the early Mesozoic and then increase throughout the Mesozoic, reaching a maximum in the Cenozoic. The Middle to Late Triassic Cassian Formation, exposed in the Dolomites, Southern Alps, northern Italy, comprises tropical reef basin and transported platform assemblages characterized by high diversity and commonly excellent preservation of fossils. The Cassian Formation yields high alpha (mean species richness per locality: 96), beta (mean Jaccard dissimilarity: 0.95), and gamma (1421 invertebrate species) diversity. The high primary diversity is probably due to the tropical reef-associated setting, and its reduced taphonomic alteration caused 4.5 times higher biodiversity to be preserved than in comparable pre-Cenozoic settings. High beta diversity can be explained by the presence of various habitat types and may also have been driven by priority effects. The Cassian fauna, like most comparable modern ecosystems, features a large number of gastropods (39\% of all invertebrates, 58\% of mollusks are gastropods). Especially small species in the millimeter size range contribute to the large number of gastropod species in the Cassian Formation. Our results support the assumption that the Modern Evolutionary Fauna was already established early in the Mesozoic and that the scarcity of small gastropods in many fossil assemblages is a taphonomic phenomenon. This contradicts the view that the major radiation of gastropods and the generally very strong increase in biodiversity largely took place in the Cenozoic. We suggest that highly complex, gastropod-dominant marine benthic ecosystems are as old as Middle/Late Triassic, pointing to an earlier establishment of the Modern Evolutionary Fauna than previously assumed. An improved eco-space utilization by infaunalization and increased biotic interactions such as a predator/prey escalation may have contributed to the high biodiversity and may reflect early aspects of the Marine Mesozoic Revolution.