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Chitinozoans: A Powerful Tool For High-Resolution Biostratigraphy Of Early Ordovician To Latest Devonian Marine Strata From Northern Gondwana Regions

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From the Ordovician to the Devonian, a huge but frequently fairly shallow marine platform extended from western Africa to the Middle East, and included the southern part of Europe. The various regions belonging to this Northern Gondwana paleogeographic Domain, bounding the Rheic Ocean to the south, shared similar sedimentological (e.g. predominating terrigenous sedimentation, Silurian anoxia, same transgressive and regressive events), climatic (e.g. impact of the late Hirnantian glaciation, progressive climatic warming during the Devonian), and faunal characteristics (e.g., single paleobiogeographic Province). These features are related to the paleolatitudinal location and to long-term free marine exchanges.

Concerning the datation of strata and events in northern Gondwana regions, the classical biostratigraphic markers for the Early Paleozoic, i.e. graptolites and/or conodonts, proved to be less efficient than on other plates. For instance, the scarcity of calcareous deposits in northern Gondwana sections, especially in the Ordovician and in the Silurian, precludes detailed conodont investigations. On the other hand, due to their uncommon occurrences, to their poor diversity and to the absence of index species, the Ordovician graptolites can hardly be used for high-resolution biostratigraphy or for age assignment in northern Gondwana regions. Consequently, an alternative dating and correlation tool has been developed based on chitinozoans as these organic-walled microfossils show interesting characteristics for high-resolution biostratigraphy. Indeed, they occur frequently in great abundance (several tens to several hundreds of specimens per gram of rock) in almost all marine sedimentary rocks (e.g. shale, siltstone, argillaceous sandstone, limestone, chert, ferruginous and phosphatic deposits). They are practically continuously represented all along the marine sequences deposited under low to moderate hydrodynamic energy. Moreover, some chitinozoan species allow direct ties with the GSSP of many Ordovician, Silurian or Devonian stages.

Because the Ordovician was a period of widespread plate distribution, and therefore of more pronounced provincialism, a specific chitinozoan regional biozonation has been erected for Northern Gondwana. At present, it includes twenty-five (25) biozones with an average duration of 2 million years each. Additional refinements are even possible at the scale of a basin (locally, an average resolution of about 1 million years can be expected in the most suitable environments). Concerning the Silurian, the global chitinozoan zonation, including seventeen (17) biozones, can be used. Again, and depending on the quality of the local sedimentary record, additional refinements can be introduced to the global zonation. For the Devonian, the provisional global chitinozoan zonation with nineteen (19) biozones is directly applicable for the marine strata in most northern Gondwana sections. The average duration of these biozones (about two

million years) can be significantly improved for some time-slices (e.g. in the Lochkovian or in the Givetian of Algeria). Consequently, from the origination of the group in the middle part of the Tremadocian to its extinction in the latest Famennian, i.e. for about 120 million years, 61 chitinozoan biozones are at present utilizable for dating and/or correlating marine strata in northern Gondwana regions.