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Carbonate Nodules: Indicators for Early Diagenetic Alteration of Periplatform Carbonates.

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Periplatform carbonates of Bahamian slopes and basins mainly consist of platform-derived material and pelagic organisms. After initial deposition, this sediment may be winnowed due to bottom currents, which increases the porosity and permeability of the sediment. This is an ideal pre-condition for early diagenesis, during which the dissolution of metastable carbonate particles such as high-Mg calcite and aragonite components (e.g. pteropods), and in return a new input of fragments <63 μm may cause a re-fining of the sediment. In contrast, cementation produces carbonate nodules, which themselves might coarsen the sediment. Major amounts of carbonate concretions, i.e. nodules, have been found in Pliocene to Holocene sediments of three ODP cores from the western and eastern margins of Great Bahama Bank (ODP Leg 166; Site 1006; ODP Leg 101; Sites 632 and 633). The nodules are white to light grey and irregular in shape; they contain whole tests or fragments of planktonic foraminifera within a very fine matrix. These kinds of nodules have been formed during early diagenesis, as has been shown by stable isotope analyses (δ^{18}O, δ^{13}C). The widely spread presence of nodules in Bahamian cores reveals them as a typical product of early diagenetic processes. Sites 632, 633, and 1006 were the first cores to be examined for the temporal distribution of nodules around Great Bahama Bank (GBB). Site 1006, located at the western margin of GBB, shows highest amounts of nodules in glacial deposits, which are much coarser than the adjacent interglacial deposits. However, in the upper 30 mbsf, the core lacks of nodules, which is interpreted to be due to a so-called flush zone. Within this flush zone, corrosive Antarctic Intermediate Water might flow into the sediment, thus hindering the cementation of nodules. Both Sites 632 and 633 are located in the Exuma Sound, a closed seaway at the eastern margin of GBB. The presence of nodules in these cores is not linked to the glacial-interglacial cyclicity, as the

latter is not characterised by large differences in the grain-size signal. Site 633 shows a steadily increasing abundance of nodules, as well as an increasing amount of coarse material with increasing core depth. Site 632 also shows increasing values of nodules and coarse material with increasing core depth. However, the grain-size pattern in this core is interrupted by single, coarser turbidite layers, which can be connected to single nodule peaks at the same depths. The results of all three cores reveal, that the formation of nodules is linked to the grain-size distribution of the sediment. On the one hand, coarser layers facilitate, due to higher porosity and permeability and thus an enhanced fluid flow, the formation of nodules. On the other hand, a high amount of nodules significantly changes the grain-size signal by increasing the coarse fraction. A model has been generated, based on these findings, which shows the development of the grain-size pattern as a result of early diagenesis in two hypothetical cases. In one case the initial grain-size pattern reveals singular, prominent coarse peaks (e.g. glacial deposits, turbidites), which, in contrast to adjacent fine sediment intervals, facilitate nodule formation. Even if this type of carbonate sediment is overprinted by early diagenesis (i.e. nodule formation), the initial grain-size pattern will not be significantly changed, as the greatest coarsening effect by nodules will occur in the initially coarser layers. The second case is based on a consistent grain-size distribution. In this case, nodules form throughout the core. Increasing amounts of nodules with increasing core depth, probably due to the advanced diagenetic processes in deeper core sections, significantly alter the grain-size distribution, making the sediment much coarser than the (hypothetical) initial signal. Thus nodule formation is intricately linked to the grain-size distribution of the sediment and is a clear indicator for early diagenetic alteration in periplatform carbonates.