

A COMPUTER-BASED SYSTEM FOR THE STORAGE AND APPLICATION OF EXPERT KNOWLEDGE IN PALEOENVIRONMENTAL INTERPRETATIONS

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ABSTRACT

The fossil remains of several marine microorganism groups are routinely used in deciphering the depositional dynamics of ancient paleoenvironments. Given their variety of adaptations to different environments and their common recovery in drill cuttings, benthic Foraminifera are the most widely used microfossil for inferring paleoenvironments. Routine industrial paleoenvironmental analysis is generally limited to the interpretation of the paleowater depth zones, but benthic Foraminifera can potentially provide additional information related to the productivity of the paleoenvironments, as well as sediment flow, pathway, and origin. There are a few biostratigraphic software packages and associated databases that help the geologist to perform stratigraphic analysis, correlation, and interpretation, but little has been done with respect to using intelligent systems that allow the geologist to produce comprehensive paleoenvironmental interpretations.

An information technology that uses a Case Based Reasoning (CBR) system for paleoenvironmental interpretations is currently under development by the Technical Alliance for Computational Stratigraphy. This system will be populated with paleoenvironmental and taxonomic knowledge in the general form of a problem definition and its corresponding solution or interpretation definition (i.e., cases), which are stored in a relational, SQL database. The CBR system will be able to analyze benthic Foraminiferal sample data and produce basic measurements (e.g., water depth; infaunal and epifaunal forms) relevant to the paleoenvironment of each of the foraminiferal assemblages represented in the data set. The CBR system can then find answers to a new problem by calculating the similarity between the new problem definition and the definition of problems of existing cases (i.e., problems with known solutions stored in the database). A problem definition within the CBR system that has a high similarity to the new

problem definition will directly provide a solution to the new problem and, weaker similarities may provide insight into the definition of a new problem and solution pair. If none of the existing cases have a high similarity to the new problem definition, then it is up to the expert to define a solution for the new problem. The new problem and solution pairs are then added to the database of cases so that over time the CBR system grows into a comprehensive repository of biostratigraphic expert knowledge.