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Abundance and Diversity Patterns of Nummulite Species of Libya as Indicators of Climatic and Tectonic Changes

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SUMMARY

The purpose of this study is to look at well data from Libya and adjacent areas of North Africa to study changes in the abundance and diversity of nummulites from the Late Paleocene to Early Oligocene, in order to further evaluate tectonic vs. climatic controls on the timing of nummulite speciation.

Nummulites are an extinct group of large benthic foraminifera that originated in the Late Paleocene, flourished in the Eocene and were extinct by the end of the Early Oligocene. Over 300 nominal species have been described, all from the Tethyan realm. It has long been thought that nummulites harboured algal symbionts, based on analogy with living counterparts, on functional morphology, and on carbon isotopic signatures. This symbiotic relationship would have restricted nummulites to living within the photic zone, as determined by water depth and clarity. Particular attention has been focused on nummulite buildups in Tunisia and Libya because they form important hydrocarbon reservoirs in fields such as Ashtart and Hasdrubal in Tunisia and Bourri and Gialo in Libya. Nummulites have also been successfully used to develop biostratigraphic zonations for the Eocene on the order of 1-1.5 my (Schaub, 1981).

The early Paleogene experienced a long-term warming trend that extended from the mid Paleocene to Early Eocene (Zachos et al., 2001). Within this period of climatic warming, a brief interval of extreme warming has been recognized, labelled the Paleocene-Eocene thermal maximum (PETM; Zachos et al, 2001). A great deal of attention has been focused in the past 10 years on the deep marine biotic response to this climatic warming event, but the shallow water biotic response has only recently been studied (Scheibner et al., 2005, Scheibner et al., 2007, Zamagni et al., 2008, and others). Scheibner et al. (2005) noted a temporary decline of extreme K-strategist larger benthic foraminifera during the PETM, and a rapid diversification during the post-PETM period .

The purpose of this study is to look at well data from Libya and adjacent areas of North Africa to study changes in the abundance and diversity of nummulites from the Late Paleocene to Early Oligocene, in order to further evaluate controls on the timing of nummulite speciation. Work is currently ongoing on cuttings samples from wells located in the Sirt and Pelagian basins of Libya and Tunisia (Fig. 1). The use of cuttings means that all data is averaged over a 10m interval. However, preliminary indications are that this level of sampling is sufficient to establish a high-resolution biostratigraphic framework within which to study (spatio-)temporal trends in nummulite abundance and diversity, and the climatic and other controls thereon. It is also sufficient to establish a high-resolution palaeobathymetric interpretation, and to enable palaeobathymetric controls on abundance and diversity to be identified and distinguished from climatic ones.

Figure 1: Map of Sirt Basin, Libya showing locations of study wells. BP acreage shown in yellow.

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