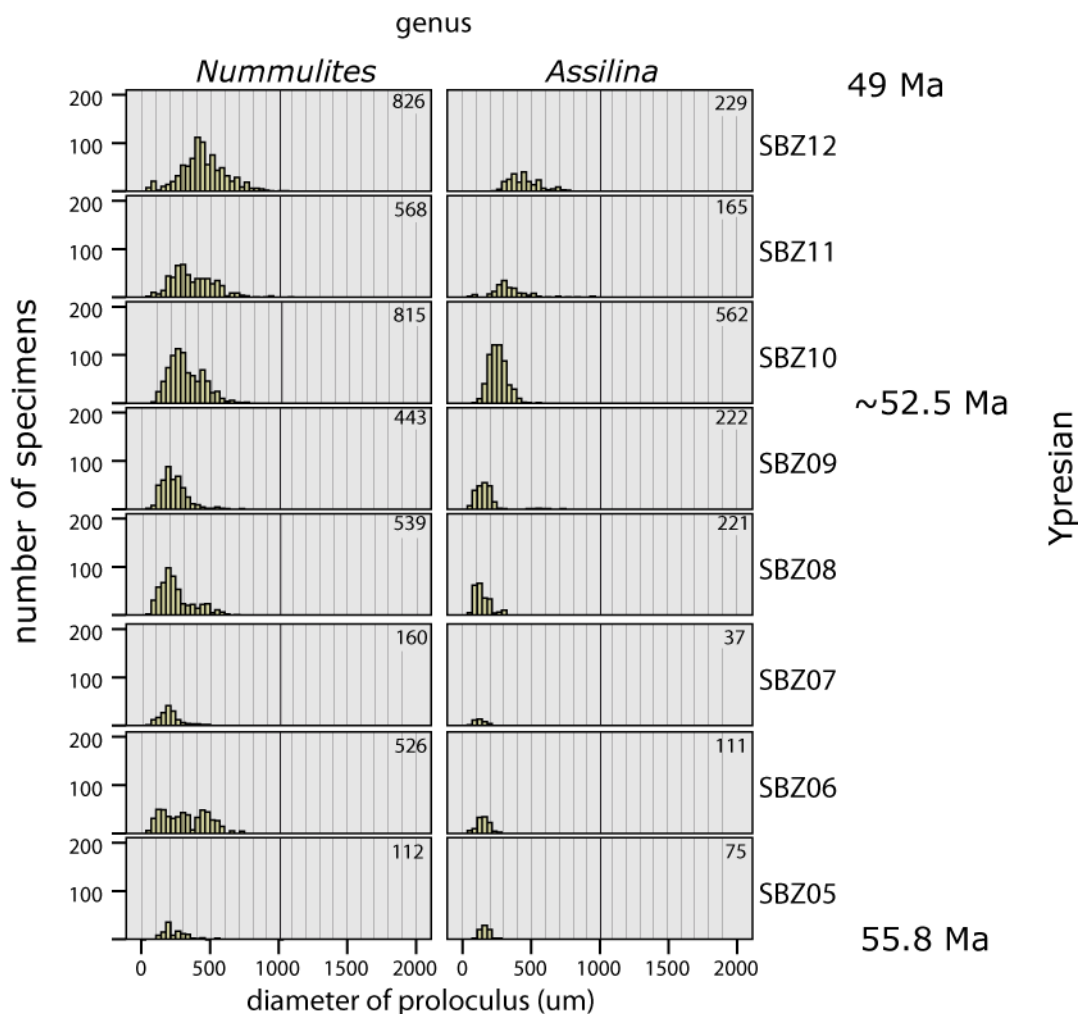


## Morphological variation in diversifying larger benthic foraminifera

*Background:* Larger, symbiont-bearing foraminifera (LBF) are the largest free-living unicellular organisms. Their calcite test, abundance and widespread occurrence in tropical shallow water deposits make them ideal study organisms for studies of evolutionary dynamics. During the Eocene tropical conditions reached as far north as the Paris Basin, including Belgium and southern England. Following recovery from the Cretaceous-Paleocene extinction event, several families show a rapid evolution that can be observed in morphological features. Evolutionary patterns differ between families and with time. For example, the oldest *Nummulites* species have been observed in the late Paleocene, but only become diverse within the Early Eocene. *Assilina* is also present in the late Paleocene, but, in contrast to *Nummulites*, does not diversify and is represented by only 1-2 lineages and at most 3-4 per time slice throughout the Early-Middle Eocene. In both genera the general trend within evolutionary lineages is an increase in the diameter of the initial chamber. These trends are, among others, reflected in histograms of proloculus diameter with time (Fig. 1).



Such trends have been detected for a very long time by many authors. Recent discussions on the mechanisms behind trends has focussed on two approaches: 1) comparing among-species morphological distributions in successive time slices, irrespective of phylogenetic patterns and 2) those comparing between ancestral and descendant morphologies. Both methods provide different insights into driving

mechanisms and morpho-space dynamics (e.g. Alroy 2000; McShea, 2000). For either application larger benthic foraminifera constitute good study organisms. Both proposed study genera, *Nummulites* and *Assilina* are abundant in the fossil record and a basis for their classification exist in a monograph dating from 1981, even though some (especially phylogenetic) aspects might be in need of revision.

*Goal:* In this project it is aimed to quantify multiple morphological characters in the evolution of *Nummulites* and *Assilina*. The main questions are:

- Is there a difference in mechanism between a species rich, and a species poor genus?
- Can this pattern be deconstructed into lineages, areas and habitat components?
- Is it possible to detect differences between trends in very diverse areas and less diverse areas?

*Tasks:* Currently a set of ~10,000 measurements of proloculus sizes is available. The work in this project will include data collection of *Nummulites* assemblages from a variety of localities, increasing the geographic area covered by the available data, and/or to collect data from well documented sections. Secondly, it will be important to design a (sub)sampling method that will reduce biases in the dataset resulting from under- or overrepresentation of certain species, areas or time-slices. It is anticipated that visits to counterparts in Italy and/or Turkey are needed. Depending on background, available funding and opportunities, these visits could be extended with fieldwork in Turkey or Spain.

*Qualifications:* Depending in the background and interest of candidates (bachelor or master students) a suitable project will be designed. Bachelor project will focus on available collections and literature, whereas master projects can involve fieldwork as well.