

## **Foraminifera**

Essentially rhizopods with granular cytoplasm (vacuoles?)

### **HISTORY OF STUDY**

- First described in literature by Strabo (63 BC to 20 AD) [Nummulites]
- 1826, Alcide D'Orbigny, First Classification of Forams
- 1835, DuJardin, (Ascribes to Protozoa)
- 1884, Brady, (Monograph HMS Challenger)

Other workers include Helen Tappan and Al Loeblich, Cushman, and Buzas

### **Test walls**

1. Organic (proteinaceous mucopolysaccharoid), thin and flexible, typical of unilocular forms, e.g. *Allogromina*, synonyms = mebraneous and tectinous
2. Agglutinated, particulate materials (fine sand and silt) held in place by cement (calcareous, tectinous, or siliceous)
3. Calcareous, some tests secreted, some agglutinated
  - Microgranular (perhaps with recrystallization)
  - Porcellaneous (imperforate)
  - Hyaline
    - maybe lamellar adding one new layer with each chamber
    - perforate (unknown function, may include gamete exits, bouyancy, O<sub>2</sub> uptake)
    - imperforate
    - test of *Patellina corrugata* a single crystal
    - some have aragonite shells
4. Opaline (problematic)

### **CHAMBERS**

1. Initial chamber = proloculus
2. Size of proloculus = bimodal
3. Alternation of generations, both sexual and asexual reproduction
  - Small = microspheric = schizont (agamont) = sexual
  - Large = megalospheric = gamont = asexual

Chamber arrangement, shape, and general morphology

- |                |                |                 |
|----------------|----------------|-----------------|
| • Cylindrical  | • Uniserial    | • Evolute       |
| • Branching    | • Biserial     | • Involute      |
| • Planispiral  | • Triserial    | • Aperture      |
| • Strobilation | • Trochospiral | • Ornamentation |

## **GEOLOGIC HISTORY**

1. Oldest forams are cylindrical agglutinated forms from the lowermost Cambrian (Lipps, 1985)
2. Agglutinated forms increase in abundance
3. Multilocular forms first occur in Devonian, become abundant by Carboniferous (e.g. biserial, triserial, trochospiral)
4. Endothyrids (granular CaCO<sub>3</sub>) first appear in Devonian, probable ancestors to fusulines
5. Fusulinacea, Late Carboniferous and Permian
6. Miliolines, appear in Carboniferous, probable ancestor naked foram (allogrominid) based on wall structure, gave rise to Early Tertiary Alveolines
7. Permian Extinction destroys fusulines and provided basis for adaptive radiation of small benthic forams
  - Rotaliina
  - Spirillina
  - Involutinina
  - Robertina

All benthic suborders were present by Triassic after Permo-Triassic Extinction because of adaptive radiation
8. Planktonic forams first appear in middle Jurassic in the north Tethys, recognized by trochospiral subglobular chambers, ontogeny probably first benthic, meroplanktic, then holoplanktic (pelagic)
9. Iterative evolution of morphological traits induces probable polyphyly into planktonic foram classification, particularly in Cenozoic
10. Keeled forms become abundant after mid-Cretaceous radiation (e.g. *Globotruncana*)
11. Planktonic forams are the "*Drosophila*" of paleontology