

GEOL 30010: Applied Palaeontology

MODULE COORDINATOR: Assoc. Prof. Patrick Orr

CREDITS: 5

MODULE LEVEL: 3

SEMESTER: II

PRE-REQUISITES/PRIOR LEARNING:

Broad-based background in biology/zoology/palaeobiology is recommended.

OVERVIEW OF MODULE:

This module introduces you to two sets of palaeobiological data that are widely used in Applied Earth Sciences: ichnofabrics and trace fossils; microfossils.

The first explores how the structures produced by organisms as they process sediment (bioturbation) are related to key variables such as depositional context, the organism's ecology and physiology, plus environmental conditions (including degree of oxygenation and sediment consistency). Use of trace fossils and ichnofabrics as a tool in basin analysis reflects their being routinely sampled in core (probably more so than macrofossils), and thus especially relevant to contexts where outcrop data is not available (e.g. offshore petroleum basins). Trace fossils and ichnofabrics are an alternative, complementary, record to body fossil data when studying key events in Earth's history. This aspect is explored using the major changes in marine ecosystems that occurred in response to the evolution and diversification of animals during the late Neoproterozoic-early Phanerozoic interval.

In the second part of the module the biology, ecology and geological history of the principal fossil groups that are routinely preserved as microfossils is considered. The key concepts of the sub-discipline of biostratigraphy (the use of fossils for the relative dating of rocks) are introduced and the roles of different microfossil groups reviewed. Emphasis is placed on how this is applied in constructing chronostratigraphic frameworks for depositional systems. The importance of microfossils as a record of environmental change in the most recent part of earth's history (the Anthropocene) in response to human activities is explored. This includes the use of microfossils (and macrofossils) as tools in conservation palaeobiology to define baseline conditions against which the extent of subsequent environmental modification can be assessed. This is a key component of determining the environmental impact of maintaining ecosystem services.

LEARNING OUTCOMES:

Upon successful completion of the module students will have an understanding of:

1. the basis on which trace fossils are named, and the principal ethologies (behaviour patterns) they represent;
2. how trace fossils are diagnostic of environmental parameters such as salinity, oxygenation, sediment consistency and water depth;
3. how the recurrent association of ichnotaxa (ichnofacies) are characteristic of specific depositional settings, and the use of this in basin analysis;
4. the practical applications of trace fossils in basin analysis, including the appearance of key ichnogenera in field contexts, as well as in randomly oriented sections typical of core;
5. the processes involved in the creation of ichnofabrics, including identifying components generated by overprinting of successive tiers within a community and the emplacement of successive communities;
6. the, as yet not fully understood, evolutionary palaeoecology of the Ediacaran/Cambrian boundary interval is documented by ichnofabrics produced by epifauna and infauna;
7. the geological record, and principal applications, of the key groups of microfossil;
8. the principles of biostratigraphy and its role in chronostratigraphy;
9. the applications of microfossils in the rapidly developing field of Conservation Palaeobiology.

ASSESSMENT:

Continuous assessment: 40%

(Exercises, oral and poster presentations that present the result of autonomous learning)

Report: 20%

(report presenting the results of independent research activities)

End of Semester Exam: 40%

(end of semester exam on entire module)