

Introduction to Paleontology

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Study of ancient life through the fossil record

1. What Is Paleontology?

Aspect	Description
Definition	Scientific discipline that investigates the history of life on Earth by examining fossils (remains, traces, and chemical signatures).
Scope	Includes organisms from microbes to megafauna, spanning from the earliest Precambrian life to the recent past (Holocene).
Goal	Reconstruct past ecosystems, evolutionary pathways, and Earth's changing environments.

2. Key Concepts & Terminology

Term	Meaning
Fossil	Preserved evidence of past organisms (bones, shells, imprints, amber, trace marks).
Stratigraphy	Study of rock layers (strata) and their chronological relationships.
Chronostratigraphy	Division of Earth's history into time intervals (e.g., Ediacaran, Jurassic).
Taphonomy	Processes that affect an organism from death to discovery (decay, burial, mineralization).
Index Fossil	Species with a short geographic range but wide temporal distribution; useful for dating rocks.
Phylogeny	Evolutionary tree showing relationships among species.
Paleoecology	Reconstruction of ancient ecosystems and interactions.
Radiometric Dating	Measuring decay of radioactive isotopes (e.g., U?Pb, K?Ar) to assign absolute ages.

3. Types of Fossils

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Category	Examples	Preservation Mode
Body Fossils	Bones, teeth, shells, leaves	Mineral replacement, permineralization, carbonization
Trace Fossils (Ichnofossils)	Footprints, burrows, feeding marks	Sediment infill, impression
Molecular Fossils	Biomarkers, ancient DNA, proteins	Chemical residues preserved in rocks or amber
Microfossils	Pollen, spores, foraminifera, diatoms	Often extracted from sediments using sieving & acid digestion

4. The Geological Time Scale (GTS)

Era	Periods (selected)	Approx. Age (Ma)
Precambrian -		4600 – 541
Paleozoic	Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Permian	541 – 252
Mesozoic	Triassic, Jurassic, Cretaceous	252 – 66
Cenozoic	Paleogene, Neogene, Quaternary	66 – present

Ma = million years ago.

5. Methods & Techniques

1. Field Work

- Mapping stratigraphic sections
- Systematic excavation and GPS recording
- Sedimentology: grain size, facies analysis

2. Laboratory Analyses

- **Preparation:** mechanical (air?scribe, micro?jacks) & chemical (acid etching).

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- **Imaging:** light microscopy, scanning electron microscopy (SEM), CT scanning, photogrammetry.
- **Geochemical:** stable isotope analysis (C, O), elemental mapping (XRF), organic geochemistry.

3. Dating & Correlation

- Relative: biostratigraphy (index fossils), lithostratigraphy.
- Absolute: radiometric (U?Pb, Ar?Ar), luminescence dating, magnetostrat