

Introduction: Ediacaran Case Study

A Sprigg's 1946 Discovery

- Red sandstone with clay partings, South Australia
- “Queer markings suggestive of jellyfish”
- Initially dated as early Cambrian
- By 1959, confirmed as Precambrian

B Evolution of Ediacaran Interpretations

- Glaessner (1959-61): soft corals, jellyfish, annelids, arthropods
- Seilacher (1980s): “Vendobionta” - quilted air-mattress forms lacking mouths/guts
- Modern view: multiple clades, “flashes of familiar biology in unfamiliar combinations”

Historical Development

A Whewell's 1832 Introduction

- Uniformitarians: nature uniform through ages
- Catastrophists: directional history with major paroxysms
- Alps formation debate: gradual vs catastrophic

B Lyell's Influence

- Merged methodological caution with empirical claims
- “Ordinary forces and time” preference
- Created lasting “creative confusion”

Forms of Understanding

A Four Distinct Types:

1. What happened: descriptive understanding (e.g., Permian extinction timing <60,000 years)
2. Why events occurred: causal explanations
3. Complex earth systems: biological-physical interactions
4. Geological record: taphonomy, resolution, fidelity

Core Questions

A Necessity Debate

- Laws of nature stability vs. geological specificity
- Donaldson's claim: all Precambrian rocks interpretable through present

B Non-uniformitarian Applications

- Alvarez impact hypothesis acceptance
- Cambrian Explosion debate: standard vs. novel mechanisms

C Anthropocene Challenge

- “Stationarity is dead” (Milly et al. 2008)
- Unprecedented greenhouse-gas forcing rates
- Debate over model revision needs

D Actualistic Studies Value

- Live-dead studies showing fine-scale fidelity
- Chenier studies revealing transgressive ravinement origins
- Lithification bias in older sediments
- Taphonomic megabiases requiring correction

Synthesis

- Present sometimes directly informative
- Sometimes past informs other past (e.g., Permian reefs via Precambrian)
- Modern stromatolites illuminate both
- Some past potentially “locked” (parts of Ediacaran bi