Case 11

The Rhynie Chert

Discovered in 1910 by an Elgin doctor, Dr William Mackie, the Rhynie chert is an unusual rock containing vivid black streaks which Mackie realised were fossilised plant stems. The Rhynie chert is now recognised as the earliest preserved ecosystem on Earth. Dated at 407 million-years-old, the chert contains early terrestrial plants, lichens, and fungi, alongside the remains of early arthropods and crustaceans. All lived in or around the edges of geothermal pools in an environment similar to that of the modern-day Yellowstone National Park. When geysers erupted, engulfing everything in hot mineral-rich water, individual cells were replaced by silica, preserving the organisms in exquisite detail.

Sketches of the Rhynie environment by the late Professor Nigel Trewin. From: *Fossils Alive!: New Walks in an Old Field*. 2008. Dunedin Academic Press. pp 256. Used with permission of Margie Trewin.

1. Models of some of the Rhynie plants
1. *Nothia aphylla*, 2. *Aglaophyton majus*, 3. *Rhynia gwynne-vaughanii*, and 4. *Horneophyton lignieri*.
Models on loan courtesy of the University of Aberdeen

2. Photomicrographs of plants from the Rhynie chert
From: Mackie, W. 1914. The rock series of Craigbeg and Ord Hill, Rhynie, Aberdeenshire. *Transactions of the Edinburgh Geological Society*, **10**, 205-23).
Reproduced with permission of The Royal Society of Edinburgh

3. Specimens of native sulphur
Sulphur is a common component of hot spring deposits. Toxic to most organisms, sulphate-reducing bacteria are able to convert sulphate to sulphide. Precipitation of the sulphides traps heavy metals reducing the toxicity of the waters.
ELGNM collection pre-1844: 998; 999 (from Sicily); 1000 from Iceland

4. Specimens containing antimony

Antimony has been identified within samples of titanium-oxide from the Rhynie chert (see 7. below). This toxic element has the chemical symbol Sb and is also known by the Arabic name of kohl. The sample in the watch-glass on the left (40) contains arsenic (As), also found in the Rhynie deposits; the watch-glass on the right (39) is the Sb-bearing mineral stibnite.

ELGNM collection: (40: Allemont, France); 39: Transylvania. Donated by Patrick Duff, 1915. For more information about Patrick Duff, see the geology display in the Rear Gallery.

5. Unpolished block of Rhynie chert

On loan courtesy of Alison Wright.

6. Photomicrographs of plants from the Rhynie chert

From: Kidston, R. and Lang, W.H. 1917-1921. On Old Red Sandstone Plants showing Structure from the Rhynie Chert Bed, Aberdeenshire (published in five parts).

Open page is Plate V from Part I. *Rhynia gwynne-vaughani*. *Earth and Environmental Science Transactions of The Royal Society of Edinburgh*. 51, 761-784. https://doi.org/10.1017/S0080456800008991

ELGNM collection

7. Extracts from Parnell *et al*., 2022

This research paper demonstrates a symbiotic partnership in the uptake of nutrients between plants and fungi inhabiting the Rhynie hot spring system. Fungi colonised the layers of plant debris, supplying trace elements to the living plants, which, in turn, contributed carbon (a by-product of photosynthesis) for metabolism by the fungi. The fungi also influenced mineralisation of the spring waters, helping to ameliorate their toxicity. Animals living amongst the plant stems also benefited from the effects that fungi had on the ecosystem.

Parnell. J., Akinsanpo, T.O., Armstrong, J.G.T., Boyce, A. J., Still, J.W., Bowden, S.A., *et al*. (2022). Trace element geochemistry in the earliest terrestrial ecosystem, the Rhynie Chert. *Geochemistry, Geophysics, Geosystems*, 23, e2022GC010647. https://doi.org/10.1029/2022GC010647

8. How the Rhynie chert is studied information board

On loan courtesy of the University of Aberdeen

9. Polished block of Rhynie chert

On loan courtesy of Alison Wright

10. Photomicrographs of plants from the Rhynie chert

Photomicrographs taken by the late Professor Nigel Trewin from cores of Rhynie chert drilled in 1997. There is no outcrop of the chert so all material is either found as ‘float’ ploughed up from the overlying fields or from cores.

11. Model of *Palaeocharinus tuberculatus*

Model of a spider-like arthropod (a trigonotarbid) from Windyfield, a site close to Rhynie. This species was discovered by the Aberdeen Rhynie Research Group and described by Steve Fayers. Model made by Stephen Caine.
ELGNM: 2018.23

Display curated by Elgin Museum Geology Group.