Detail of the Late Triassic reptile *Leptopleuron lacertinum* from the Lossiemouth Sandstone Formation, Moray. Elgin Museum.© Davide Foffa

Review of Fossil Collections in Scotland

Aberdeen and North East

National Museums Scotland

John Ellerman Foundation

Aberdeen and North East

Elgin Museum (Moray Society)
Falconer Museum (Moray Council)
Stonehaven Tolbooth Museum
The Discovery Centre (Live Life Aberdeenshire)
Arbuthnot Museum (Live Life Aberdeenshire)
Zoology Museum (University of Aberdeen Museums)
Meston Science Building (University of Aberdeen Museums)
Blairs Museum

Elgin Museum (Moray Society)

Collection Type: Independent
Accreditation: 2019
Recognised Collection of Fossils: 2008

1 High Street, Elgin, Moray, IV30 1EQ
Contact: curator@elginmuseum.org.uk

Location of collections
In 1836 a group of local figures, notably Reverend Dr George Gordon of Birnie (1801-1893), town clerk Patrick Duff (1791-1861), Rear Admiral Archibald Duff (1773-1858), banker John Lawson (1799-1852) and Isaac Forsyth (1768-1859), formed the Elgin Scientific Society with the intention of providing Elgin with a museum to preserve the growing collection of fossils from the surrounding area. Previous accommodation for the early collection included the town jail and rooms in various other buildings across the town. Elgin Museum was built on the High Street and opened in 1843. The first curator was John Martin (1800-1881) and a keeper, William Ingram (ca.1800-1873), lived onsite. Today, the Museum is still run independently by the same society, now known as the Moray Society. In 2008, Elgin Museum's collection of fossils was Recognised by Museums Galleries Scotland as Nationally Significant to Scotland. Fossils are present onsite in displays and a dedicated storeroom.

Size of collections
1,500-1,600 fossils.

Onsite records
Fossils are listed in a Microsoft Excel spreadsheet, compiled as part of a 2014-2015 Recognition Fund project to review and document the Recognised Collection and other fossil material onsite, with information also on MDA cards. A considerable archive also forms part of the Recognised Collection.

Collection highlights
1. Devonian fish from historically and scientifically important localities in the local area.
2. 'Elgin reptile' fossils from the Permian and Triassic, collected from quarries near Elgin.
3. Examples of diverse Permian vertebrate trace fossils.
4. Fossils linked to founding members of the Elgin Scientific Society.
5. Fossils linked to local figures, notably Lady Eliza Gordon Cummings of Altyre (ca.1798-1842) and William Taylor (1849-1921).
6. Triassic reptile fossils studied by Thomas Henry Huxley (1825-1895).
7. Nine fish and reptile type specimens.

Published information
Agassiz, L. (1844–1845). *Monographie de poissons fossiles des Vieux Gres Rouges ou Systeme Dévonien (Old Red Sandstone) des Îles Britanniques et de Russie.* Neuchâtel: Soleure, chez Jent and Gassmann.
Andrews, S.M. (1982). *The discovery of fossil fishes in Scotland up to 1845*. Edinburgh: Royal Scottish Museum Studies.
Ahlberg, P.E. (1998). Postcranial stem tetrapod remains from the Devonian of Scat Craig, Morayshire, Scotland. *Zoological Journal of the Linnean Society*. 122:99-141.
von Baczko, M.B., and M.D. Ezcurra. (2016). Taxonomy of the archosaur *Ornithosuchus*: reassessing *Ornithosuchus woodwardi* Newton, 1894 and *Dasygnathoides longidens* (Huxley 1877). *Earth and Environmental Science Transactions of the Royal Society of Edinburgh*. 106:199-205.
Bennett, S.C. (2020). Reassessment of the Triassic archosauriform *Scleromochlus taylori*: neither runner nor biped, but hopper. *PeerJ*. 8:e8418.

Benton, M.J., and A.D. Walker. (1985). Palaeoecology, taphonomy and dating of Permo-Triassic reptiles from Elgin, North-East Scotland. *Palaeontology*. 28:207-234.
Collie, M. (1991). Huxley the Public Figure. In *Huxley at Work*. London: Palgrave Macmillan.
Collie, M., and S. Bennett. (1996). *George Gordon: An annotated catalogue of his scientific correspondence*. Scolar Press.
Dróżdż, D. (2018). Osteology of a forelimb of an aetosaur *Stagonolepis olenkae* (Archosauria: Pseudosuchia: Aetosauria) from the Krasiejów locality in Poland and its probable adaptations for a scratch-digging behavior. *PeerJ*. 6:e5595
Friedman, M. (2007). Cranial structure in the Devonian lungfish *Soederberghia groenlandica* and its implications for the interrelationships of 'rhynchodipterids'. *Transactions of the Royal Society of Edinburgh: Earth Sciences*. 98:179-198.
Groome, F. (ed.). (1882-1884). *Ordnance Gazetteer: Elginshire*. Edinburgh: Thomas C Jack.
Kammerer, C.F., K.D. Angielszyk, and J. Frobisch. (2011). A comprehensive taxonomic revision of Dicynodon (Therapsida, Anomodontia) and its implications for dicynodont phylogeny, biogeography and biostratigraphy. *Journal of Vertebrate Palaeontology*. 31 (Supplement 1):1-158
Keeble, E., and M.J. Benton. (2020). Three-dimensional tomographic study of dermal armour from the tail of the Triassic aetosaur *Stagonolepis robertsoni*. *Scottish Journal of Geology*. 56:55-62.
Mantell, G.A. (1852). Description of *Telerpeton elginense*, a fossil reptile recently discovered in the Old Red Sandstone of Moray: with observation on the supposed fossil ova of batrachians in the Lower Devonian strata of Forfarshire. *Quarterly Journal of the Geological Society, London*. 8:100-109.
Parker, W.G. (2018). Anatomical notes and discussion of the first described aetosaur *Stagonolepis robertsoni* (Archosauria: Suchia) from the Upper Triassic of Europe, and the use of plesiomorphies in aetosaur biochronology. *PeerJ*. 6:e5455.
Peacock, J.D. (1968). Geology of the Elgin District. *Memoirs of the Geological Survey Scotland*. Edinburgh: HM Stationery Office.
Säilä, L. K. (2010). Osteology of *Leptopleuron lacertinum* Owen, a procolophonoid parareptile from the Upper Triassic of Scotland, with remarks on ontogeny, ecology and affinities. *Earth and Environmental Science Transactions of the Royal Society of Edinburgh.* 101:1-25.
Trewin, N.H. (2013). *Scottish Fossils*. Edinburgh: Dunedin Academic Press.

Collection overview

The geology collection is divided into a larger part designated as a Recognised Collection and smaller part that is not Recognised. Fossils of the Recognised Collection are from three main stratigraphic levels: the Devonian (entirely fish), Permian (trace fossils and rare body fossils) and Triassic (reptile body fossils). Fossils from the Middle Devonian are *Coccosteus, Pterichthyodes*, *Mesacanthus*, *Cheiracanthus*, *Diplacanthus*, *Cheirolepis* and *Glyptolepis* and *Gyroptychius* from Tynet Burn, Lethen Bar and Dipple Bray. Examples of *Dipterus* from Achanarras are also present. Upper Devonian fish are *Asteroplepis*, *Psammosteus*, *Glyptopomus*, *Rhynchodipterus*, *Phaneropleuron*, *Bothriolepis* and *Holoptychius* from Kingsteps, Alves and nearby Carden Moor, Bishopmill, Pluscarden, the Quarrywood area west of Elgin (Rosebrae, Newton, Laverocklock) and Scaat Craig to the south of Elgin. The Permian is represented by the reptiles *Gordonia*, *Geikia* and *Elginia* and the Triassic by *Hyperodapedon*, *Stagonolepis*, *Ornithosuchus*, *Brachyrhinodon, Leptopleuron* (Fig. 2)*, Scleromochlus* and *Saltopus*, collected from quarries at Lossiemouth, Spynie and Findrassie; many fossils of these taxa are now located in other collections (Natural History Museum, London, and British Geological Survey, Keyworth). The dicynodont skull model ('the fossil that isn't there') represents a void in a block from the Permian Hopeman Sandstone Formation of Clashach Quarry, found in 1997. The block was CT and MRI scanned, then cast in 3-D by researchers at the University of Glasgow. The original block is on display in Elgin Museum with a Recognition-funded cast of the skull including the lower jaw; The Hunterian also displays a copy of the model. The Recognised Collection also includes Permian footprint and trackway fossils from Clashach Quarry, and other local sites, some in large slabs. Research by Carol Hopkins (unpublished) describes the traces as comparable in terms of abundance and diversity to those in equivalent rocks of Dumfries (Locharbriggs and Corncockle Sandstones formations), Germany (Cornberger Sandstein) and Arizona (Coconino Sandstone). The part of the collection not

Recognised comprises approximately 100 mostly invertebrate and plant fossils, many of which are not from the local area. Examples are Ordovician trilobites, Silurian corals, slabs of Silurian Much Wenlock Limestone Formation and Devonian Rhynie Chert, Carboniferous *Neuropteris*, *Calamites* and *Alethopteris* with *Mariopteris*, cephalopods (several ammonites, fragments of belemnites and a polished nautiloid), *Gryphaea* bivalves (Jurassic), echinoids (Jurassic and Cretaceous), shark teeth (Eocene), a brittle star from Spynie (in Devensian Spynie Clay), fossil wood and other loose, isolated invertebrates (brachiopod, bivalve, crinoid). A large ammonite fossil is labelled as transported to the area by a glacier.

Figure 2: Skeleton of the Triassic procolophonid reptile *Leptopleuron lacertinum* from Lossiemouth, Moray (Elgin Museum)

Research/collection links

Although many of the reptiles and fish from the collections were studied soon after their discovery, recent work using improved techniques and higher resolution, for example on *Leptopleuron* and the re-study of the upper Devonian lungfish *Rhynchodipterus,* highlight their continuing scientific potential. Recent research visitors have included palaeontologists from Venezuela (Neto), Poland (Dróżdż), National Museums Scotland (Foffa, Panciroli, Zaher) and Birmingham (Henderson), underlining the national and international importance of the Elgin fauna. Three-dimensional tomographic studies of reptile fossils have proved particularly useful in the identification of additional (and hitherto unknown) features (see Keeble & Benton, 2020) and active research is being undertaken by Foffa at National Museums Scotland: https://royalcommission1851.org/elgin-reptiles-the-origins-of-the-modern-terrestrial-fauna. Studies of the Triassic vertebrate trace fossils from Clashach near Hopeman, undertaken in the 1990s-2000s, have not been published in academic literature, although accounts by Carol Hopkins have appeared in the 2007 Elgin Museum *Sea to Sand Conference Proceedings* and in articles published by The Geologists Association magazine *Earth Heritage*. The quarries at Clashach (Permian) and Spynie (Triassic) are SSSIs, although they continue to be worked for building stone with the potential for ongoing study. As indicated above, researchers are publishing on topics relating to fossil species found in Moray with material in Elgin Museum but are not necessarily referencing this material. Similarly, information appears about Permian trackways without the authors having visited Moray or referencing the collection or the work of Carol Hopkins at Clashach. The Elgin Museum Geology Group has considerable knowledge of local palaeontology, its history and the find sites and is always willing to assist with any research enquiries or visits.

Falconer Museum (Moray Council)

Collection Type: Local authority
Accreditation: 2017

Tolbooth Street, Forres, Moray, IV36 1PH
Contact: museum.forres@moray.gov.uk

Location of collections
The Falconer Museum, located close to the main street, was founded in 1871 at the bequest of locally-born Alexander Falconer (1797-1856) for a public museum in Forres. His younger brother Hugh (1808-1865) is also credited as a founder, and to whom many objects in the collection are linked. Both brothers spent time in India. Collections are displayed in the Museum with a separate offsite store a short distance away.

Size of collections
500-1,000 fossils.

Onsite records
The fossils are accessioned with entries in an Adlib CMS. A paper catalogue contains identification and origin information.

Collection highlights
1. Miocene fossils from the Siwalik Hills, India, linked to Hugh Falconer (1808-1865).
2. Vertebrate, invertebrate and plant fossils from Scottish, UK and Worldwide localities.

Published information
Agassiz, L. (1844–1845). *Monographie de poissons fossiles des Vieux Gres Rouges ou Systeme Dévonien (Old Red Sandstone) des Îles Britanniques et de Russie.* Neuchâtel: Soleure, chez Jent and Gassmann.
Falconer, H., and P. T. Cautley. (1847). *Fauna Antiqua Sivalensis*. London: Smith, Elder and Co.
Falconer, H. (1863). *On the American Fossil elephant of the regions bordering the Gulf of Mexico (E. Columbi, Falc.): With General Observations on the Living and Extinct Species*. Natural History Review 3:43-114.

Collection overview
Most of the material (more than 300 specimens) is vertebrate (mammal and crocodile) bone fragments and plants from the Siwalik Hills (Fig. 3), collected by Hugh Falconer in the early-mid 1800s. Fossils are typically described as being from the Miocene of India, although the Siwalik Hills today includes part of Pakistan, and the Siwalik Group, representing fluvial environments, is thought to cover a wider interval of Cenozoic time from the Oligocene to Pleistocene. Specimens demonstrating the diversity of the fossils are on display: a buffalo skull and jaw, second buffalo skull, large leaf fossil, elephant tusk, two pieces of hippo skull and a hippo ankle bone, with an extensive collection of material in storage. It is possible that some fossils might have been illustrated in *Fauna Antiqua Sivalensis* (1847), a catalogue of the finds produced at the time. The collection also includes fossil wood from the same locality. A mammoth tooth in the collection is also linked to Hugh Falconer and his work on American elephants, which he published in a monograph (Falconer 1863).

The remaining part of the fossil collection is more diverse in terms of origin. A limited number of specimens are from the Devonian locally, including fish (acanthodians, placoderms, *Holoptychius*) and indeterminate plant fragments. The collection otherwise comprises a range of fossils from beyond the local area, such as the Devonian fish *Diplopterus* from Orkney and '*Estheria*' from Thurso, Carboniferous fish (*Rhizodus*, *Megalichthys, Psammodus* from Armagh) and plants (*Cyclopterus* from Coalbrookdale, Shropshire), and Permian fish (*Palaeoniscum* from East Thickley,

Durham). The Jurassic is represented by bivalves (*Pinna* from Dundry, *Gryphaea*), ammonites (*Cardioceras*), belemnites and gastropods (Inferior Oolite of France), plants (*Williamsonia* from Scarborough) and an *Ichthyosaurus* rostrum from Bushley, Gloucestershire. Fossils from the Chalk are mainly echinoids (*Cidaris*, *Clypea*, *Clypeaster*, *Echinocorys*) and there are examples of leaves in tufa that may be from the Paleocene Ardtun leaf beds of Mull. The diversity and wide-ranging origins of specimens is emphasised by trilobites from Mount Stephen (Canada), *Pecopteris* from the Carboniferous of Illinois, coral from Ontario (Canada), *Diplomystus* from the Cretaceous of Syria, Eocene foraminifera from Egypt, fish from the Eocene Monte Bolca of Italy (*Myripristis*) and Jurassic Solnhofen Limestone of Germany (*Leptopteris*), and a bone breccia from Les Eyzies, Dordogne, France. The label for a specimen of the fish *Mesopoma mantelli* from the Chalk of southern England references a publication by Agassiz, suggesting it is figured. Blocks of wood with hand-written taxonomic, stratigraphic and geographic information and nails at strategic points, a former method of labelling and storage/display, are associated with most of the fossils.

Figure 3: A Miocene crocodile skull from the Siwalik Hills (Falconer Museum)

Research/collection links

The material from the Siwalik Hills is important historically and still of interest; the fossils were examined as recently as late 2019 by a researcher from India. Although most of the vertebrate specimens from the Siwalik Hills are fragmentary, many are distinct enough to be identified taxonomically and have been described as rare and significant by a researcher (Oxford University Museum of Natural History; JEPC Pers. Comm.). The Siwalik material in the Falconer Museum is effectively unknown and therefore unstudied; it could provide enough material for a masters-level project, or higher, if investigated alongside material in other Scottish collections that is also perhaps not known scientifically (for example, fossils housed in the Meston Science Building (University of Aberdeen Museums) and Nairn Museum). Thorough examination of the collection of other fossils onsite would be worthwhile.

Stonehaven Tolbooth Museum

Collection Type: Independent

Old Pier, Stonehaven Harbour, Aberdeenshire, AB39 2JU
Contact: enquiries@stonehaventolbooth.co.uk

Location of collections
The Museum is located at Stonehaven Harbour in a building dating from the 1500s. The Museum opened on the site in 1975 and was under the management of Aberdeenshire Council until 2011. It is now run by the local community. The collections, including fossils, are on display.

Size of collections
11 fossils.

Onsite records
The collection is documented in an Excel spreadsheet.

Collection highlights
1. Variety of arthropod fossils and a model of the millipede *Pneumodesmus*.

Published information
Wilson, H.M., and L.I. Anderson. (2004). Morphology and taxonomy of paleozoic millipedes (Diplopoda: Chilognatha: Archipolypoda) from Scotland. *Journal of Paleontology*. 78:169-184.

Collection overview
Material is variable and attributed to an unknown, but still active, local collector: A slab with two Devonian fossil fish (Orkney), a Devonian eurypterid and approximately 4 examples of the extinct crustacean *Dictyocaris* (shown with illustrations of the similar *Ceratiocaris*) found locally at Cowie. The fossils in the 300 million-year-old coal-bearing limestones of Fife include crinoid and plant fragments. In the same case are polished orthoconic nautiloids from Morocco. Displays describe the millipede *Pneumodesmus newmani* from the Cowie Formation exposed nearby at Cowie, thought until recently to be the oldest air-breathing animal known; the rocks have since been re-dated to 414 million years old with other millipedes now known from older sediments, although *Pnemodesmus* is the oldest fossil shown to possess spiracles necessary to breath air out of water. The specimen on display is a model; the original fossil is in the National Museums Scotland collection, although there is an imprint of a *Pneumodesmus newmani* fossil in the display, under a magnifying glass.

The Discovery Centre (Live Life Aberdeenshire)

Collection Type: Local authority (Live Life Aberdeenshire)
Accreditation: 2018

Station Road, Mintlaw, Aberdeenshire, AB42 5EE
Contact: museums@aberdeenshire.gov.uk

Location of collections
The Discovery Centre facility in Mintlaw was purpose-built in 2004 to house the stored collections of the Aberdeenshire Museums Service.

Size of collections
1,000-2,000 fossils.

Onsite records
Collection information is in an Excel inventory and Adlib CMS. The fossils are not catalogued although they have been examined and organised by a volunteer with palaeontological knowledge. MDA cards filling 30 or so metal filing cabinets are in the main storeroom, recording every specimen onsite and material transferred to the location, notably 'Ex Banff'. Documentation is still being reviewed and revised. An online catalogue is available at: http://aberdeen-asp.adlibhosting.com/.

Collection highlights
1. Devonian fossil fish from the north east of Scotland.
2. Fossil fish linked to HMS *Vernon* are potentially historically important.
3. Brachiopod fossils from Linksfield, Elgin, potentially linked to John Lawson (1799-1852).

Published information
Davidson, R.G., and N.H. Trewin. (2005). Unusual preservation of the internal organs of acanthodian and actinopterygian fish in the Middle Devonian of Scotland. *Scottish Journal of Geology*. 41:29-134.
Jolly, W. (1870). Notes on the geology of Southerness, Kirkcudbrightshire. *Transactions of the Edinburgh Geological Society*. 1:278-284.

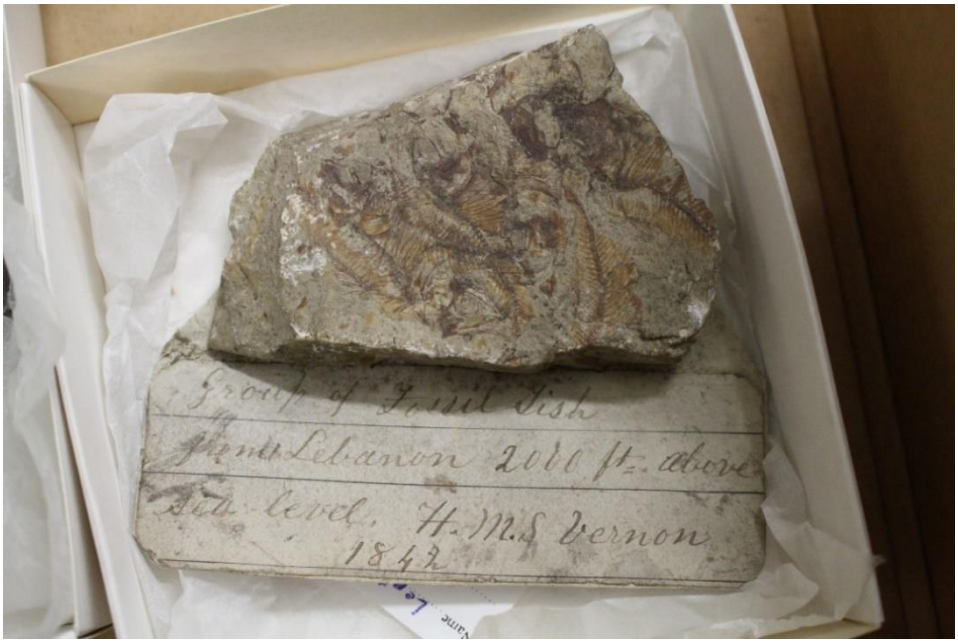

Figure 4: Cretaceous fish from Lebanon collected on an HMS *Vernon* voyage (The Discovery Centre, Aberdeenshire Museums Service)

Collection overview

The collection includes material originating in Scotland, the UK and worldwide. Most of the vertebrates are fish from north east Scotland. Middle Devonian specimens include *Osteolepis* (Caithness, Lethen, Orkney, Tynet Burn, Cruaday in Orkney), *Coccosteus* (Lethen, Clune, Edderton), *Cheirolepis* and *Glyptolepis* (Tynet Burn, Gamrie/Corbie Burn), *Gyroptychius* (Edderton), *Dipterus*, *Acanthodes* and *Cheirocanthus* (Tynet Burn), *Pterichthys*, *Pterichthyodes* (Lethen Bar, Tynet Burn, Gamrie) and *Palaeospondylus* (Achanarras). Upper Devonian specimens are of *Bothriolepis* (Clune, Whitemire) and *Asterolepis* (Whitemire); some specimens assigned to Lethen (Middle Devonian) are perhaps from Altyre Burn (Upper Devonian). A Devonian coprolite was found among other indeterminate fragments. A *Dipterus* is described as the 'impression of fish in clay slate from near Thurso Mr A Robertson 1839' and possibly linked to Alexander Robertson (1816-1854) who visited Orkney among other places across Scotland to study geology; several fish also have labels indicating identification by Bob Davidson in 1999. A 360 million-year-old *Osteolepis* from Cruaday is a former 'object of the month', the taxon highlighted as a distant relative of tetrapods that first crawled onto land.

Fish specimens from other levels include several *Rhizodus* teeth and *Megalichthys* from the Carboniferous, a *Lepidotus* scale (Jurassic), the Lower Liassic (Jurassic) fish *Pholidophorus* from Lyme Regis (label reading 'From Bryce M Wright, 90 Great Russell Street, London'), the fish *Mallotus* in a nodule (no age could be determined but relatively recent), various shark teeth (origins include Malta) and vertebrae of unknown age and origin. A shark tooth is labelled as being an Eocene *Carcharodon* tooth, although this taxon did not appear until slightly later, during the Miocene. An interesting specimen is labelled as a 'group of fossil fish from Lebanon 2000ft above sea level HMS *Vernon* 1842' (a frigate launched in 1832); the fish might be Cretaceous (Fig. 4). Other fossils are an ichthyosaur vertebra ('James Wallace esq.' named on the label), a second smaller vertebra, bison astragalus (Windy Knoll, Castleton), horse tooth from the River Thames and a tusk. A box labelled as 'non-fish' with the name 'Brown' contains a mammoth tooth.

Invertebrate fossils from Scotland include sponges dredged from the Moray Firth dated 1893, solitary and colonial corals (*Lithostrotion* from the Carboniferous of Beith and Southerness, Dumfries, the latter perhaps linked to William Jolly), bivalves (many from the Carboniferous, including mussel bands), Jurassic molluscs (Clynelish, Sutherland), Jurassic gastropods and belemnites (Brora, Eathie Haven, 'Port an Righ 1972'). Ammonites are from Eathie (Cromarty) and Blackpots Clay Pit (White Hills) with several dredged from the Moray Firth or collected from Plady (Aberdeen shore). A greater proportion of invertebrates is from outside Scotland. Palaeozoic fossils include graptolites, trilobites, bryozoans, crinoids, brachiopods, bivalves (Carboniferous *Anthracoma* from Bradford; *Anthracosia* from Whaley Bridge) and gastropods (*Euomphalus*). Fossil brachiopods, the coral *Halysites* and a range of other invertebrates are from the Silurian Much Wenlock Limestone Formation (Dudley and Shropshire). Several fossils (fish from Cromarty, belemnites from Brora) have labels attributing them to AA Woodham (possibly Anthony A Woodham, a former keeper of the National Museum of Antiquities of Scotland, Edinburgh, and member of the Society of Antiquaries of Scotland) collected during archaeological excavations. A small collection of brachiopods from Linksfield near Elgin is potentially linked to John Lawson, one of the founders of Elgin Museum, who visited quarries in the Elgin area to collect fossils and presented studies of them in lectures to the Elgin Scientific Society, of which he was president.

Invertebrates from the Mesozoic are almost entirely from outside Scotland and organised by stratigraphic stage. For example, Jurassic fossils are stored in boxes labelled Liassic, Bajocian, Bathonian, Callovian, Oxfordian, Kimmeridgian and Portlandian with the contents including echinoids (*Clypeaster*, flint echinoid), ammonites and aptychi, vertebrae, reptile 'paddles' and the bivalves *Plagiostoma, Gryphaea,* various oysters, inoceramids and *Trigonia* from the Stonesfield Slate of Oxfordshire. A box labelled as Aptian represents the Cretaceous with a number of fossils elsewhere in Cretaceous Chalk. Material representing the Cenozoic originates from several well-known localities, such as the Eocene Bracklesham Beds of Hampshire (gastropod *Athleta*).

Plant fossils include material from the Devonian Rhynie Chert of Aberdeenshire, *Adianites hibernicus* and fossil ferns in Devonian sandstone from Kiltorcan (County Kilkenny, Ireland, Fig. 5), *Psilophyton*, and other indeterminate plant fragments. Many plant fossils are typical of the Carboniferous: *Lepidodendron*, *Stigmaria*, *Sphenopteris*, *Calamites* (one from St Helens), *Sigillaria* (Bishop Aukland), *Stigmaria* (Durham), with fossil ferns and other fragments from coal fields (notably at Burdiehouse and Glasgow (one dated 1877)), and 'ferns Castle Carry' possibly from Castlecary near Glasgow. Labels reading 'Natural History Collection of James Gaul', a collector in Edinburgh, are found on several fossils, including a *Calamites*. An example of fossil wood is from Dysart, Fife.

Figure 5: Frond of the Devonian plant *Adianites hibernicus* from Kiltorcan, County Kilkenny, Ireland (The Discovery Centre, Aberdeenshire Museums Service)

Research/collection links

A box labelled 'Huntly Fish' would be worth investigating as this origin/collection has not been noted elsewhere. A box containing fish from Tynet Burn is labelled as 'Figured' although the reference is not apparent; several boxes contain unsplit nodules from Tynet Burn which have the potential for scientific study especially as the exposures are now inaccessible. The fossils linked to the frigate HMS *Vernon* and the brachiopods from Linksfield, Elgin, could be investigated to determine their historic/scientific value.

Arbuthnot Museum (Live Life Aberdeenshire)

Collection Type: Local authority (Live Life Aberdeenshire)
Accreditation: 2018

St Peter Street, Peterhead, Aberdeenshire, AB42 1QD
Contact: museums@aberdeenshire.gov.uk

Location of collections
The Arbuthnot Collection was founded in the home of local merchant Adam Arbuthnot (1773-1850) on Jamaica Street and was well known by 1837. Following his death in 1850 the collection was bequeathed to the town of Peterhead and moved to several locations before the building of a museum, which opened in 1893. The Arbuthnot Museum is a few minutes from the town centre on the first floor of a building shared with the community library. Collections are displayed in the Museum with storage located offsite at The Discovery Centre, Mintlaw.

Size of collections
5 fossils.

Onsite records
Electronic information is managed from The Discovery Centre, Mintlaw.

Collection overview
Fossils are displayed in drawers in the family-focused Mr Arbuthnot's Gallery. These are a *Dactylioceras* ammonite from the Jurassic of Yorkshire (probably Whitby), shark tooth labelled *Carcharodon* from Malta, fragment of fossil wood (Carboniferous *Stigmaria*) from a coal mine in Wemyss, Fife, an *Inoceramus* bivalve in flint from south east England and another fragment of fossil wood brought back from Egypt by Captain Lawrie.

Zoology Museum (University of Aberdeen Museums)

Collection Type: University
Accreditation: 2017
Recognised Collection: 2007

Tillydrone Avenue, Aberdeen, AB24 2TZ
Contact: museum@abdn.ac.uk

Location of collections
The Zoology Museum is located in the Zoology Department and is the display area for zoological specimens from the University of Aberdeen Museums collection. Specimens were amassed through 200 years of teaching and research activities by staff and students and donations from graduates and friends of the University. Collections at the Museum are part of the University of Aberdeen Collection Recognised in its entirety by Museums Galleries Scotland as Nationally Significant to Scotland. The collection includes fossils located throughout displays.

Size of collections
50-70 fossils.

Onsite records
There are MDA cards for every specimen with a third of these so far transferred to a Calm CMS. Information is also in ABDUS, a version of CARD Box. Old RN numbers indicate specimens that have at some time been located in Marischal College. An online catalogue including fossil specimens is available at: https://www.abdn.ac.uk/museums/collections/index.php.

Collection highlights
1. Diversity of fossils used to complement modern representatives.
2. Fossils from important localities: Rhynie, Hopeman, etc.

Collection overview
As the Museum's displays and collections focus on zoology, fossil specimens are included with their modern representatives for comparison and to illustrate important features of the respective group. For example, displays with interpretation for Echinodermata, Brachiopoda and Bryozoa include fossils of echinoids (*Cidaris*, *Spatangia*, *Clypeaster*, *Micraster* and several sand dollars), crinoids (*Pentacrinus*, *Encrinus, Marsupites*) and crinoidal limestone (from the Carboniferous and Ordovician), brachiopods (small groups of *Rhynchonella*, *Terebratula*, *Strophomena* and *Spirifera* affixed to boards and several brachiopods in limestone, many probably from the Silurian Much Wenlock Limestone Formation, and a boxed *Waldheimia*), and a rock sample with the bryozoan *Fenestella*.

Molluscs include fossilised cephalopods (Fig. 6), mostly ammonites listed as *Phylloceras*, *Hildoceras*, *Dactylioceras*, *Stephanoceras*, and several 'Ammonita' sp., *Nautilus*, *Orthoceras*, and belemnites, including one from the Oxford Clay and two with rare preservation of ink sacs. Two large samples of driftwood are extensively bored by the bivalve *Teredo navalus*. A single specimen represents fossilised crustaceans: the crab *Oxystomata* with other arthropod fossils including the anterior half of a large eurypterid and the trilobites *Encrinurus*, *Calymene*, *Phacops* and *Odontochile*. The next cabinet shows tubes from the worm *Serpula sulcata* on a bivalve. Corals include two *Heliolites* (one polished), *Calceola*, *Blothrophyllum* and *Lithostrotion* displayed in boxes, two *Cyathophyllum* on small stands, corallites in rock matrix cut to show internal structures, a sample of the fan coral *Gorgonia* (Venus sea fan) and two *Favosite*s representing the Palaeozoic and Recent. A specimen is labelled as *Brachyphyllum*, now listed as a plant fossil. Sponges are illustrated by *Selicothon*, *Siphonia*, *Doryderma*, *Rhabdonema* and *Ventriculites*. Protozoa include large examples of the foraminifera *Nummulites* from Egypt (several almost 6cm across) and China

Sea (0.5cm). Other fossils are the *megalodon* teeth among fish in alcohol and a *Mastodon* tooth next to a modern elephant tooth. A relevant themed display case shows a model of a *Coelacanth*.

The entrance area includes several cases containing samples of Rhynie Chert, ammonites and trilobites, Carboniferous *Sigillaria* and *Protaxites* trunk, trackway from the Permian Hopeman Sandstone Formation, Moray, two additional trackways, bivalves from the Cretaceous Greensand, a slab of Upper Devonian sandstone with fish from Dura Den and an algal stromatolite.

Figure 6: A display of cephalopods comparing modern and fossil specimens (Zoology Museum, University of Aberdeen)

Meston Science Building (University of Aberdeen Museums)

Collection Type: University

Recognised Collection: 2007

32 Elphinstone Road, University of Aberdeen, Aberdeen, AB24 3EU
Contact: museum@abdn.ac.uk

Location of collections
The University of Aberdeen Collections were founded in 1751 with objects accumulated since through teaching and research activities by staff and students and donations from graduates and friends of the University. It now comprises an estimated 300,000 objects. The entire University of Aberdeen Collection is Recognised by Museums Galleries Scotland as Nationally Significant to Scotland. Fossils are located throughout the Meston Science Building in two basement rooms, a teaching store and displays in department corridors.

Size of collections
12,000 fossils.

Onsite records
Collection information is on a Calm CMS; only part of the fossil collection is documented. MDA cards for the fossils are present in one of the basement rooms. All specimens with numbers belong to the Museum Collection; teaching specimens are not numbered. An online catalogue is available at: https://www.abdn.ac.uk/museums/collections/index.php.

Collection highlights
1. Samples of Rhynie Chert.
2. Invertebrate trace fossils from worldwide, linked to Nigel Trewin (1944-2017).
3. Triassic vertebrate trackways from Moray.
4. Collection of Devonian fish from the north east of Scotland.
5. Miocene vertebrate fossils from the Siwalik Hills, India.
6. Fossils of the Triassic reptile *Stagonolepis*, some linked to James Nicol (1810-1879).
7. Trace fossils, Devonian plants and fossil assemblages from the Pentland Hills, linked to Professor Henry Alleyne Nicholson (1844-1899).
8. Carboniferous shark type material from the Mendips linked to Gordon M Walkden.
9. Carboniferous fossils attributed to John Baird Simpson (1894-1960) and A[dam] W Whyte.
10. Solnhofen fossils linked to Carl Friedrich Häberlein (1787-1871) and/or his son Ernst Häberlein (1819-1886).

Published information (selected)
Aldiss, D.T., and E.J. Edwards. (1999). *The geology of the Falkland Islands*. British Geological Survey Technical Report. WC/99/10.
Benton, M.J. and A.D. Walker. (1985). Palaeoecology, taphonomy, and dating of Permo-Triassic reptiles from Elgin. *Palaeontology*. 28:207-234.
Carroll, S., and N.H. Trewin. (1995). *Cornulatichnus*: a new trace fossil from the Old Red Sandstone of Orkney. *Scottish Journal of Geology*. 31:37-41.
Davidson, R.G., and N.H. Trewin. (2005). Unusual preservation of the internal organs of acanthodian and actinopterygian fish in the Middle Devonian of Scotland. *Scottish Journal of Geology*. 41:129-134.
Fraser, N.C. (1982). A new rhynchocephalian from the British Upper Triassic. *Palaeontology*. 25:109-725.
Fraser, N.C. (1986). New Triassic sphenodontids from south-west England and a review of their classification. *Palaeontology.* 29:165-186.

Fraser, N.C. (1988). The Osteology and Relationships of *Clevosaurus* (Reptilia: Sphenodontida). *Philosophical Transactions of the Royal Society B*. 321(1204):125-178.
Fraser, N.C., and S. Renesto. (2005). Additional drepanosaur elements from the Triassic fissure infills of Cromhall Quarry, England. *Jeffersonia*. 15:1-16.
MacLennan, A.M., and N.H. Trewin. (1989). Palaeoenvironments of the late Bathonian to mid-Callovian in the Inner Moray Firth. In Batten, D.J., and M.C. Keen. (eds.). *Northwest European Micropalaeontology and Palynology*. Chichester: Ellis, Horwood.
Newman, M.J. and N.H. Trewin. (2001). A new jawless vertebrate from the Middle Devonian of Scotland. *Palaeontology*. 44:43-51.
Nicholson, H.A. (1872). Contributions to the study of the errant annelides of the older Palaeozoic rocks. *Proceedings of the Royal Society of London*. 21:288-290.
Ogilvie, S., K. Glennie, and C. Hopkins. (2000). Excursion guide 13: The Permo-Triassic sandstones of Morayshire, Scotland. *Geology Today*. 16:185-190.
Renesto, S., and N.C. Fraser. (2003). Drepanosaurid (Reptilia: Diapsida) remains from a Late Triassic fissure infilling at Cromhall Quarry (Avon, Great Britain). *Journal of Vertebrate Paleontology*. 23:703-705.
Rice, C.M., N.H. Trewin, and L.I. Anderson. (2002). Geological setting of the Early Devonian Rhynie cherts, Aberdeenshire, Scotland: an early terrestrial hot spring system. *Journal of the Geological Society*. 159:203-214.
Trewin, N.H. (1975). *Isopodichnus* in a trace fossil assemblage from the Old Red Sandstone. *Lethaia*. 9:29-37.
Trewin, N.H. (1976). Correlation of the Achanarras and Sandwick Fish Beds, Middle Old Red Sandstone, Scotland. *Scottish Journal of Geology*. 12:205-208.
Trewin, N.H. (1986). Palaeoecology and sedimentology of the Achanarras fish bed of the Middle Old Red Sandstone, Scotland. *Earth and Environmental Science Transactions of The Royal Society of Edinburgh*. 77:21-46.
Trewin, N.H. (2000). The ichnogenus Undichna, with examples from the Permian of the Falkland Islands. *Palaeontology*. 43:979-997.
Trewin, N.H. (2013). *Scottish Fossils*. Edinburgh: Dunedin Academic Press.
Trewin, N.H., P.R. Gurr, R.B. Jones, and P. Gavin. (2012). The biota, depositional environment and age of the Old Red Sandstone of the island of Kerrera, Scotland. *Scottish Journal of Geology*. 48:77-90.
Trewin, N.H., and K.J. McNamara. (1994). Arthropods invade the land: trace fossils and palaeoenvironments of the Tumblagooda Sandstone (? late Silurian) of Kalbarri, Western Australia. *Earth and Environmental Science Transactions of The Royal Society of Edinburgh.* 85:177-210.
Trewin, N.H., and S.R. Fayers. (2016). Macro to micro aspects of the plant preservation in the Early Devonian Rhynie cherts, Aberdeenshire, Scotland. *Earth and Environmental Science Transactions of the Royal Society of Edinburgh*. 106:67-80.
Trewin, N.H., and H. Kerp. (2017). The Rhynie and Windyfield cherts, Early Devonian, Rhynie, Scotland. In Fraser, N.C., and Sues, H-D. (eds.). *Terrestrial conservation Lagerstätten—windows into the evolution of life on land*. Edinburgh: Dunedin Academic Press.
Walker, A.D. (1961). Triassic reptiles from the Elgin area: *Stagonolepis*, *Dasygnathus* and their allies. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*. 244:103-204.

Collection overview

The collection reflects the research interests of staff throughout the department's history, notably James Nicol (1810-1879), Professor Henry Alleyne Nicholson (1844-1899) and, more recently, Nigel Trewin (1944-2017). There are fossils sampling localities in Scotland, with as many originating from the wider UK and worldwide. The collection includes historic, research and teaching specimens. Accession numbers are written on coloured dots on the specimens: blue dots indicate palaeontological specimens, as opposed to rock (white) or mineral (yellow). Red dots indicate inclusion in what was a former teaching collection displayed in Marischal College until the early 1990s. Some fossils have both blue and red numbers.

Specimens with red dots tend to represent historic localities from around the world, although the ages of some rock units and taxonomic affinities have changed since original description/addition. The collection is organised stratigraphically. Cambrian fossils are *Orthis lenticularis* from the (St Davids-Merioneth) Upper *Lingula* Flags and *Girvanella* from Girvan. Silurian fossils are eurypterids (*Erretopterus*, *Slimonia*, etc) from Logan Water, Lesmahagow, the trace fossil *Skolithos canadensis* from the Stiperstones, Shropshire, *Crossopodia scotica* from the Gala Group of Thornylee, Peebles, various invertebrate fossils from the Much Wenlock Limestone Formation of Shropshire and Dudley, fish remains from the Ludlow Bone Bed, Shropshire, Llandovery Government rock with *Pentamerus* brachiopods, Shropshire, and a *Megalomus* from Elora, Ontario (Canada). Devonian fossils are mostly fish from the north east of Scotland (Tynet Burn, Gamrie) and Fife (Dura Den), and *Parka decipiens* from Canterland Den, Fife. Carboniferous fossils are predominantly of plants (*Annularia*, *Asterophyllum*, *Sphenopteris*, *Cordaites*, *Neuropteris*, *Stigmaria* as examples) from localities including Barnsley and Radstock, with bivalves from the mussel band at Cumnock, relatively large crinoid stems from Roscobie and Chapel, Fife (dated 1907, Fig. 7), brachiopods (notably large productids), and numerous solitary and colonial corals. One cut block of coral reef debris is from the Creek bed, Jefferson County, Illinois. A vertebrate specimen is labelled as the ‘scales of *Palaeoniscus,* a bony fish Burdiehouse Limestone Burntisland, Fife’.

Figure 7: Sections of Carboniferous Crinoid stems from Roscobie, Fife
(Meston Science Building)

Triassic fossils are from the Rhaetian Bone Bed of Aust Cliff, Gloucestershire, with several bone fragments and impressions of the reptile *Stagonolepis* from the Triassic of Moray. A fragment of *Stagonolepis robertsoni* is associated with a fragile label reading ‘J Nicol 1877’ in a glass vial. Jurassic fossils are mainly marine reptiles (vertebrae from ichthyosaurs and a plesiosaur) and a small fish skeleton surrounded by manganese dendrites from the Solnhofen Limestone of Germany. The Cretaceous is represented by invertebrate fossils, notably flint echinoids, various ammonites, inoceramid bivalves and sponges from the Upper Chalk of localities including Bridlington. Fossils from the Cenozoic are invertebrates typical of the Eocene London Clay from the London Basin and Pliocene Coralline Crag from Suffolk, with more unusual fossils of ‘a plant *Cinnamonium*

polymorphyum Oligocene Priessen, Bohemia', radiolarian chert from Abington, and fossil wood from Ghizeh, Antigua and Netluarsuk Waigat Strait, North Greenland. Additional specimens of interest are the Triassic trace fossil described as jellyfish impressions, four Middle Permian *Ullmania* trace fossils from Hilton/Frankenberg, one mentioning Dr F Krantz, Berlin, and an approximately two-metre long framed cast of a eurypterid (figured in Trewin 2013).

The Research collection includes a large amount of variably sized Rhynie and Windyfield Chert samples from Aberdeenshire, collected for the remains of early plants, fungus, lichens and invertebrates in a resistant silicified rock. Labels on the front of drawers containing Windyfield Chert highlight systematic excavation ('Rhynie Research Project, Trench 03/T1 Trewin & Fayers 'Moray Firth' Trench material C.M. Rice Published material') over several years (1997, 2000, 2016, 2017).

Trace fossils are from the Devonian, Permian and Triassic, with many mentioning Nigel Trewin (initials NHT) as the collector and/or co-author on research. Origins include Kerrera, Staffin, Cadh'an Righ, and Brora. There are several Devonian traces (*Siskemia*, *Diplichnus*), including holotype and paratype material of *Isopodichnus stromnessi* from the Stromness Flags of Breck Ness, *Nereites* in turbiditic sediments from the Carboniferous of Cabo de Favaritx, Minorca (Fig. 8), *Lockeia* with burrows of the bivalve *Neomiodon* from the Jurassic Great Estuarine Series of Trotternish, Skye, and traces labelled 'NHT from the M ORS nr Birsay, Orkney, collected with Steve Andrews June 12 2006' with notes describing these as unusual and unique. Fossils of the trace *Cornulatichnus* from Inganess Bay (Kirkwall, Orkney) and Calf Sound (lighthouse, Eday, Orkney) are noted as figured and paratype material. An interesting specimen preserves a drag mark with a *Pterichthyodes* fish at the end, figured in Trewin (1986). Trace fossils from the Silurian are of *Dictyodora* from Thornylee Quarry and *Cardiolites* from Grieston Quarry (both Innerleithen). Permian trace fossils are *Undichna*, *Umfolozia, Longula* and *Siskemia* from localities in the Falkland Islands, such as Sealion Island, Camilla Creek, Fox Bay and Cantera Coast. Trace fossils without visible locality information include *Planolites*, *Diplocraterion*, *Spirodesmos*, *Cochlichnus*, *Haplotichnus*, *Treptichnus*, *Scovenia, Mermia* and additional annelid traces, arthropod resting traces and drag marks. Trackways from the Triassic Hopeman Sandstone Formation of Moray demonstrate diversity comparable to coeval rock units in Germany (Cornberger Sandstein) and Arizona (Coconino Sandstone) (unpublished research by Carol Hopkins).

There is also an extensive collection of Devonian fish mostly attributed to Nigel Trewin and colleagues/students. Lower Devonian fossils include *Parexus* from the Dundee Flagstone Formation of Carmyllie Quarry, Letham, Angus, also the source of arthropods and rare plants. Middle Devonian fossils are *Osteolepis* and *Gyroptychius* from the Sandwick Fish Bed (Cruaday Hill and Orkney generally) and *Dipterus* and numerous *Palaeospondylus* from Achanarras. Upper Devonian fossils are *Asterolepis* from Kingsteps near Nairn and fish from Dura Den. A fish skull bone from Helmsdale is in rock visually more consistent with Devonian, as opposed to Jurassic, outcrops locally and would be worth investigating. Carboniferous fish include *Euphyacanthus*, several *Ctenacanthus* (one from Busbie), *Rhizodus* (teeth and scales) and *Strepsodus* teeth among many others from these and other stratigraphic ages. Permian fossils are of the fish *Palaeoniscum freieslebeni* from the Kupferschiefer of Freisleben, Saxony, Germany, and *Palaeoniscum* from the Marl Slate of Frislington Quarry, County Durham. Labels read '*Palaeoniscus'*, an incorrect spelling introduced some time ago and still widely present in literature and collections.

A cabinet labelled as 'type and figured' contains vertebrate material from Cromhall Quarry, Gloucestershire. This material was not examined by the JEPC, although a literature search found publications on Triassic reptiles from fissure fill deposits, authored by Dr Nick Fraser (National Museums Scotland) and Silvio Renesto (a researcher in northern Italy) among others.

The remainder of the fossil collection is herein described as reference/teaching. Sponges are diverse in comparison to other collections with examples of Ordovician *Astylospongia* (Estonia), Carboniferous *Petraia* (Mulloch Hill), *Fasciculophyllum* (Fife) and *Plocoscyphia* (Folkestone), Jurassic *Gypellia* (Bavaria), Cretaceous *Siphonia*, *Thamnospongia* and *Raphidonema* (the latter

specifically from the Faringdon Sponge gravel), with other localities including Hanover. Bryozoan fossils are also diverse (*Monticulipora*, *Favositella*, *Fascicularia*, *Heteropora* among others) with many held in drawers labelled as 'type'. The source of *Ascodictyo*n specimens is also given as the Hamilton Group of Ontario, with *Ceramopora* from Arkona, Ontario; *Monticullipora* and *Ceramopora* are from the Ordovician of Cincinnati, and a label identifies a specimen from Russia. Corals include the Ordovician *Streptolasma*, many examples from the Silurian Much Wenlock Limestone Formation (*Ptychophyllum* (*Westrogothia*), *Favosites*, *Cyathophyllum* and *Zaphrentis*) Silurian *Goniophyllum* from the Visby Marls of Gotland, Devonian *Pleurodictyum* and *Actinoistroma* from the Koblenz Beds of Gerolstein, Eifel, and Carboniferous *Lithostrotion* (Beith, Bristol, Kendal, Derbyshire) and *Caninia* (Fife). Canada is the source of several corals: *Favosites* from the Silurian Niagara Limestone, *Cystiophyllum* from the Devonian Hamilton Series of Arkona, Ontario and *Diphyphyllum* from the Carboniferous of Wainfleet, Walpole, and Port Colborne, Ontario.

Stromatolites are from the Carboniferous Randerston Limestone of Kingsbarns, Fife, Shark Bay, Australia, and the Pilbura region of Western Australia, dated to 3.5 billion years ago; stromatoporoids are of the Ordovician alga *Nidulites* from Mulloch Hill, Angus. Graptolites are represented by Ordovician *Dicranograptus* and *Climacograptus* from the Hartfell Shale of Dob's Linn, *Dicranograptus* from the Glenkiln Shale at Abington, *Didymograptus* from the Skiddaw Slate of the Lake District, Abereiddy Bay and the Arenig of the Quebec Group of Point Levis and Carlside Edge, Quebec, and Silurian *Monograptus* from Spengill, Sedburgh.

Figure 8: The Carboniferous invertebrate trace fossil *Nereites* from Cabo de Favaritx, Minorca (Meston Science Building)

Brachiopods include representative fossils from most geological periods, for example, productids from the Carboniferous of Scotland, Fife, Bristol, etc, *Rhynchonella* from the Kimmeridge Clay and terebratulids from the Inferior Oolite, Greensand, Chalk and London Clay. Multiple examples of *Leptaena* are from North America and Canada. Bivalves include typical specimens (*Gryphaea*, oysters, inoceramids) from the UK, with labels for *Posidonella* from the Delaware Creek Member (Caney Shale Formation) of Clarita, Coal County, Oaklahoma. Gastropods are also wide ranging with Palaeozoic examples present, such as *Omphalotrochus* from the Silurian of Ironbridge, although greatly exceeded by those from the Mesozoic and Cenozoic (Eocene Barton and

Woolwich beds (*Melania*), Oligocene Headon Beds, Pliocene Coralline and Red Crag) and Recent (*Murex*); one gastropod might be from the Eocene of Verona, Italy, better known for well-preserved vertebrate fossils. Cephalopods are represented by fossil ammonites (noted localities include Burton Bradstock, Charmouth, Whitby and Brora Clay Pit) and nautiloids including *Orthoceras* from the Carboniferous. Trilobite fossils are present in the collection, although difficult to access; those examined include *Elrathia* from the Cambrian Wheeler Shale Formation of Utah, *Ogygia* from the Cambrian (St David's-Merioneth Series) *Lingula* Flags of Builth, *Harpes* from Bohemia, *Calymene* from the Silurian of Dudley and Niagara, *Goldius* from the Silurian of Lochkow, Bohemia, and *Phacops* from the Devonian of Ontario. Other arthropods include *Caryocaris* (phyllocarid crustacean) from the Ordovician Skiddaw Slate.

Vertebrate fossils include the Carboniferous fish *Rhizodus* (notably a specimen showing a large, complete lower jaw with teeth; the visible part of one tooth anteriorly is more than 10cm in length), fish from the Cretaceous of Lebanon, three fish vertebrae one each from the Eocene London Clay, Wealden (Cretaceous) and Red Crag (Pliocene), and a *Dapedius* from the Liassic of Lyme Regis in a wooden frame. A *Leptopteris* from the Solnhofen Limestone has a label mentioning the Häberlein Collection. Carl Friedrich Häberlein (1787-1871) was a doctor in Pappenheim who collected fossils from the Solnhofen Limestone and received an *Archaeopteryx* specimen as payment for medical treatment which he sold with other fossils to the British Museum - the London specimen. His son Ernst Häberlein (1819-1886) was also a collector and in 1877 obtained the second *Archaeopteryx* which became the Munich specimen. Other fossils are a *Plesiosaurus* vertebra with bivalve encrustation from the Liassic of Lyme Regis, two larger vertebrae labelled as *Ichthyosaurus* from Lyme Regis, fragments of an elephant jaw labelled as Siwalik Hills (usually described as being Miocene from India, although deposits are now noted to have a wider stratigraphic (Oligocene-Pleistocene) and geographic (India and Pakistan) range), proximal end of a *Bos* femur from the Pleistocene of Siswan, Chandigarh, India, and mastodon tooth from Myanmar.

Plant fossils (some with green numbers) from the Carboniferous are labelled as *Sigillaria*, *Calamites*, branching plant from Burntisland, Fife, *Lepidodendron* (Midcalder Coal Measures), *Cyclopteris* from Dudley, *Plypterocarpus* (seed of *Neuropteris*) from Roystone, Yorkshire, and a small *Sphenophyllum* from the Westphalian donated by Mr Barnes with a label describing similarities to *Telangium* affine (*Sphenopteris* leaf) from Burdiehouse, Edinburgh. Plants from other levels are of *Salix caprea* (willow) from the Quaternary of Taubach (Thuringia), leaf 'impressions' in travertine from Tivoli near Rome, dicotyledon leaves from Burntisland associated with other calcareous remains in Recent tufa, specimens from Mull, a plant with labels mentioning a Lough Neagh plant bed and Christen Collection, and several samples of possible calcareous cave deposits. A collection of small, often indeterminate/unlabelled plant fragments is attributed to John Baird Simpson (1894-1960).

Parts of the collection are represented by material collected for the assemblages of fossils they contain. For example, there are rocks with brachiopods, bivalves, *Nidulites* and gastropods from the Starfish Bed in the Ordovician Drummock Formation of Girvan (South Threave), and brachiopods from the Charlestown Main Limestone of Bishop Hill, Kinross. Pennsylvanian (Carboniferous) brachiopods, coral, bryozoans and gastropod fossils from Oaklahoma and Texas have a distinct yellow label reading 'Museum of Invertebrate Paleontology The University of Kansas'. There are several specimens of 'stretched/disrupted belemnites', in which tectonic extension produced voids later infilled with white crystalline growth that can be used to determine the direction and amount of extension; although speculative, the JEPC is aware of a locality in France where these can be found. Drawer labels highlight numbered sets of fossils used for teaching. These include parts of cidaroid and euchinoid echinoids (plates, lanterns, spines), Jurassic and Cretaceous *Cidarus*, *Melonechinus*, *Echinus*, *Salenia*, *Holaster*, *Hemicidaris*, *Pygaster*, *Conulus*, *Clypeaster*, etc, and crinoids (complete animals, ossicles, crinoidal limestone), such as the Jurassic *Pentacrinus* and a slab of well-preserved crinoid stems surrounded by reef debris (notably trilobite) from the Devonian of Canadigua, New York State, America. Labels reading 'the nature of the fossil record' suggest some specimens were used for teaching.

Research/collection links

The findings of studies on the Clashach footprints and trackways have only been presented in a limited number of publications (Ogilvie *et al* 2000; Benton and Walker 1985) and collaboration with Carol Hopkins (through Elgin Museum) would ensure the research is available. Fossils of *Stagonolepis* and mammals from the Siwalik Hills could add information to current knowledge.

Blairs Museum

Collection type: Independent

Blairs College, South Deeside Road, Blairs, Aberdeenshire, AB12 5YQ
Contact: curator@blairsmuseum.org.uk

Collection overview
In 2019 the Museum held approximately 20 fossils, all Devonian fish preserved in nodules from Tynet Burn, Moray, attributed to Canon John Kyle (1828-1917). The fossils are part of a larger collection transferred as a loan to National Museums Scotland (approximately 63 fossils). This entry notes the possible movement of the remaining fossils from Blairs Museum to National Museums Scotland, although ownership would remain with the College. Other fossils are of the Carboniferous coral *Lithostrotion* found on the shore at Arbigland (Fig. 9) and an ammonite, bioclastic rock predominantly made of coral (a type of crag?) and serpulid (worm) tubes, all without information, which formed part of a small teaching collection associated with the former Blairs Seminary.

Figure 9: The Carboniferous colonial coral *Lithostrotion* from Arbigland (Blairs Museum)