

# Archibald Geikie and the Elgin reptiles



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**Abstract:** Archibald Geikie had some involvement in Victorian controversies over the age and interpretation of the Permian–Triassic Elgin reptiles. His early patronage by Roderick Murchison, and his biography of Murchison, gave him an unusual position, both in praising his older mentor and also in dealing with some of the mistakes he made. Murchison long held to the notion that the yellow sandstones at Elgin were all Devonian in age, even as more and more specimens of Mesozoic-style reptiles emerged. He eventually accepted that the palaeontological evidence trumped his beloved field observations, and it is likely Geikie never doubted the true age. Later, Geikie was honoured when a dicynodont from Elgin, *Geikia*, was named after him by Geological Survey staff palaeontologist E.T. Newton (1840–1930). The circumstances surrounding this choice of name remain uncertain.

Archibald Geikie (1835–1924) is not known for his work in palaeontology, but he had two connections to the Permo-Triassic reptiles of Elgin in NE Scotland. First, as Director of the Geological Survey in Scotland from 1867 and then as Director-General of the Geological Survey of Great Britain from 1882 until his retirement in 1901, and biographer of his predecessor, Sir Roderick Murchison (1792–1871), Geikie had to accept the growing evidence that the Morayshire reptile-bearing sandstones were indeed Permo-Triassic in age, and to reconcile this with his admiration for Murchison who persisted for some time in the mistaken interpretation that they were Devonian in age. Second, Geikie was honoured by Edwin T. Newton, Palaeontologist to the Geological Survey, who named a Late Permian reptile from Elgin after him, *Geikia*.

## Murchison, Geikie and the age of the Morayshire sandstones

When the first reptile fossils were discovered in NE Scotland, it was assumed that they came from the Old Red Sandstone (=Devonian), and there was a long-running debate about the true age of these beds (Diemer 1996). The yellow sandstones north and west of Elgin were quarried for building stone during the late eighteenth and the nineteenth centuries, and they comprised unequivocal Old Red Sandstones with fishes lying stratigraphically below younger sandstones with reptiles. In the field, it is hard to discern any unconformity between these two yellow sandstones, even though at least 100 myr of Carboniferous and Permian is absent. The lithology

of the two yellow sandstones is very similar, the Permian and Triassic sandstones having been reworked from lithified Devonian sandstones and redeposited with minimal sorting or rounding of grains. The first Elgin reptile fossil comprised a series of large scales discovered in 1844 at Lossiemouth, 10 km north of Elgin, which were named *Stagonolepis* by Agassiz (1844) and classified as a thick-scaled ganoid fish typical of the Old Red. This did not perturb any opinion of the day.

Confidence in the age of the Morayshire yellow sandstones was shaken by two reports in the *Quarterly Journal of the Geological Society of London* in 1852: Lambert Brickenden (1809–1900) presented a report (Brickenden 1852) on a series of small footprints on a slab from the yellow sandstones on the coast; and, in the following paper, Gideon Mantell (1790–1852) named a new skeleton of a small reptile from the upper part of the Elgin sandstones at Spynie Quarry as *Telerpeton elginense* (Mantell 1852). These reports raised doubts about the true age of the Elgin sandstones, but neither Brickenden nor Mantell ventured a strong argument either way. In comments after the papers had been delivered at the Geological Society, Roderick Murchison, the great field geologist, declared the beds to be definitely Old Red, although, in discussion of Mantell's paper, he even suggested that they might belong to the later Oolite (Middle Jurassic) that occurred on the opposite coast at Golspie (Benton 1983, p. 129).

The question of the age of the Elgin sandstones had wide implications, both geological and philosophical. The philosophical aspect hinged on the concept now called 'progressionism', whether life

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had progressed in some way through geological time from simple to more complex forms. Most field geologists, including Murchison in the 1840s and 1850s, were convinced that life had progressed, and this was also accepted by a young Charles Darwin, all based on their observations of British geology. The ancient Cambrian and Silurian sediments in Wales contained supposedly simple organisms such as graptolites and trilobites, whereas the younger Devonian (=Old Red Sandstone) abounded with fishes and land plants, and then great reptiles occurred in the Mesozoic, and mammals in the Cenozoic.

In insisting on a Devonian age for the Elgin sandstones with reptile remains (footprints, skeletons), Murchison was in some ways being perverse. He was primarily a field geologist, a keen observer skilled at discerning the structure and sequence of the rocks and turning those observations into geological maps and stratigraphic sections. His enthusiasm for establishing an ordered table of geological periods meant he had to accept the progression of fossil types, as established earlier as keys to stratigraphy by William Smith (1769–1839). To accept that the Elgin reptiles were Devonian, he had to perform contortions in his tabulations of fossil successions through geological time, especially as presented in his great geological monographs (e.g. Murchison 1839, 1854, 1867).

Murchison (1859) gave a detailed account of why he maintained these views, and his evidence was entirely based on field observations. In that paper, he described the Old Red Sandstone along the shores of the Moray Firth, noting the unequivocal evidence of its Devonian age from numerous specimens of armoured fishes and eurypterids. He reported his fieldwork in 1840, together with the views of several geologists from the north of Scotland, all confirming a Devonian age for the Elgin sandstones. He described the yellow sandstones at Lossiemouth, Spynie and Findrassie quarries, all worked for building stone and all yielding reptile fossils. As he wrote (Murchison 1859, p. 427):

[T]he observer can scarcely doubt that the mass of the yellow and whitish sandstones are simply the conformable upward continuations of the true Old Red Sandstone ... Thus, at Bishop Mill, immediately to the north of Elgin, the gritty sandstones, passing from red to yellow colours and containing scales of *Holoptychii*, so dip to the N. and by W. that, though the junction is hidden, they must infallibly pass under the beds with *Stagonolepis*, which at the Findrassie quarry apparently dip at the same low angle and in the same direction.

He continued to say the same thing about the transition from the upper Old Red Sandstone to Upper Permian Cutties Hillock sandstones west of Elgin:

Now, I satisfied myself, when in company with Mr. G. Gordon, that these red beds with ichthyolites

form the lower part of the yellow sandstone ridge, which, whether it contains reptiles at its eastern end, or becomes a pebbly conglomerate towards its western extremity in the north of west, seems to be one and the same deposit.

These conclusions fuelled the progressionism v. non-progressionism debate at that time, several years before Darwin published his *Origin of Species* in 1859. Charles Lyell (1797–1875) had argued in the 1830s that modification of fossil forms had neither direction, beginning nor end, and that plants and animals emerged whenever the environment was suitable. Therefore, he might have been content to find human fossils in the Silurian or to expect dinosaurs to come back at some time in the future, if climates became warm enough. These seemingly bizarre views were respected in the 1840s and 1850s because of the importance of Charles Lyell as a writer on geology and promoter of uniformitarianism. There was a race between Owen and Mantell to name the new Elgin reptile. This skeleton had been named a few weeks earlier than Mantell's (1852) paper, as *Leptopleuron lacertinum* by Owen (1851), and this earlier name has priority. Lyell cited the specimen as evidence of Mesozoic-style reptiles in the Paleozoic, in line with his non-progressionist views (e.g. Lyell 1852), and Mantell supported his view.

Out of regard for Murchison, younger palaeontologists and geologists did not overtly deny his view of the age of the Elgin sandstones, although few accepted it. Owen and Thomas Huxley (1825–95) recognized the advanced nature of the Elgin reptiles, and they both accepted progressionism, making it obvious to them that the reptile-bearing Elgin sandstones were Triassic in age (Benton 1983), a view strengthened for Huxley (1859) when he realized *Stagonolepis* was not a fish but a crocodile-like reptile. Huxley's position was potentially awkward: in his two positions at the time, both as lecturer at the Royal School of Mines and as Naturalist (effectively, official palaeontologist) at the Geological Survey, Murchison was his superior. Perhaps his employment status explains why Huxley at that time was unwilling to categorically announce that the Elgin reptiles could not possibly be Old Red Sandstone in age (see Diemer 1996). Or, perhaps, Huxley recognized that Murchison's interpretation could potentially be valid as it was supported by field relationships, as confirmed by numerous geologists, and Huxley was taking a cautious line in order to protect his reputation should Murchison ultimately be proven correct. Despite his unwillingness to deny the possibility of a Devonian age for the Elgin reptiles, Huxley was able to identify a third reptilian taxon from the Elgin sandstones, *Hyperodapedon gordonii*. He commented at the end of his descriptions that the new discovery concerning *Stagonolepis*, 'leads one

to require the strongest stratigraphical proof before admitting the palaeozoic age of the beds in which it occurs'. Despite the caveat embedded in this statement, this was enough for Lyell, and he promptly changed his views, writing to Canadian palaeontologist John W. Dawson (1820–99) in 1860:

I abandon the Old Red reptile, which will gratify the progressionists, some of whom still feel inclined to adhere to it. The *Telerpeton* I mean. If Darwin's theory is ever established, it will be by the facts and arguments of the progressionists such as Agassiz, whose development doctrines go three parts of the way, though they don't seem to see it

(K. Lyell 1881, vol. 2, p. 339).

Murchison held on for nearly another decade. Huxley's evidence that *Stagonolepis* was a crocodile-like reptile did not alter Murchison's (1859) view based on field evidence, although he admitted that the discovery of *Hyperodapedon* 'has [...] somewhat shaken the belief' (Murchison 1859). However, when Huxley reported specimens of close relatives of *Hyperodapedon* from Triassic strata of Warwickshire and India in 1867, Murchison rewrote parts of the new edition of *Siluria* (Murchison 1867, p. 267) to incorporate this change, and discussed progressionism in more detail and with greater confidence: 'to such fossil evidence as this the field geologist must bow'. It is interesting to note that the local naturalists in Elgin were still arguing for an Old Red age for the reptiles, even as late as the 1890s – no doubt they were loth to give up the world's oldest reptiles (e.g. Gordon 1892).

Archibald Geikie entered the arena late, but he had to manage certain sensibilities. Even though his major focus was on the granites and schists of the NW Highlands, Geikie had done fieldwork around Elgin several times. For example, one of his field notebooks (Geological Survey Notebook 'V', dated 1879; Edinburgh University Library, Special Collections GB 237 Coll-74) includes his notes and drawings from Fife and Elgin. In his autobiography, Geikie says little about Elgin and the sandstones, other than making passing reference to the geological class he led from Edinburgh University in 1878, which visited the Old Red Sandstone at Nairn, and 'completing the programme by a visit to Elgin and the Triassic sandstones so well exposed on the coast at Lossiemouth' (Geikie 1924, p. 165).

At about this time, Geikie (1875) published his definitive biography of Murchison, commissioned by the great man himself, and produced 4 years after his death. Geikie made some mention of Murchison's involvement in the Elgin sandstones and reptiles. He quoted (Geikie 1875, vol. 2, p. 120) a letter Murchison wrote about the famous Geological Society meeting of 1852 where Mantell presented *Telerpeton*:

I have just been seeing the confounded frog that leaped in the primeval Devonian days [...] And he is to wag his tail next meeting, to the infinite delight of Lyell, who is inebriate with joy, and who will have him out in a new edition before we can launch him in our own Journal.

On the same page, Geikie gave the view current in 1875: 'No true reptilian remains have yet been met with in the Old Red Sandstone, for the strata yielding the scutes of *Stagonolepis* are now referred to the Trias'. Geikie (1875, vol. 2, pp. 224–225) introduced the theme again, in reference to Murchison's work around Elgin in 1858 and 1859, noting:

[H]is conviction that in spite of the recognised reptilian grade of *Telerpeton*, and possibly of some of its contemporaries, the strata yielding their remains could not be separated from the Old Red Sandstone.

In a footnote, Geikie (1875, vol. 2, p. 225) noted:

In spite of the apparent gradation of the Elgin reptiliferous Sandstones into strata of undoubted Old Red Sandstone age, Murchison eventually surrendered this point and accepted them as of Triassic date.

These appear to be fair and balanced remarks, perhaps reflecting a tension between Geikie's self-regard and willingness to rewrite history to place himself in the best possible light, but also his desire to glorify his illustrious precursor, Murchison (Oldroyd 1990; Taylor, this volume, in review).

Of course, these debates about the Elgin sandstones were an appendix to the main issue of Scottish geology that dominated Murchison's and Geikie's lives, which has been called the 'Highlands Controversy' (Oldroyd 1990). Murchison sought to impose a simple layer-cake view on the geology of the north of Scotland, with the oldest rocks in the west, and ever younger rocks to the east. James Nicol (1810–79), later Professor of Natural History at Aberdeen University, had done fieldwork with Murchison, and recognized a major dislocation in the region of what was later identified as the Moine Thrust, and that the rocks of the NW were much older than Silurian and had been subject to considerable metamorphism and tectonic upheaval. Murchison reported on his geological excursions in northern Scotland in 1858 and 1859, and then undertook a 2 month fieldtrip together with Geikie exploring through the Western Isles, and back and forwards across the Highlands. This was a formative experience for the 24 year-old Geikie, and he maintained the Murchisonian view of Scottish geology, the 'Survey view', long after all others had abandoned it (Oldroyd 1990).

In painting these Victorian characters as masters of delusion, it is hard to discover who might have been the more pompous or self-regarding. Murchison is commonly characterized as arrogant and overwhelming, both in person and in print (e.g. Oldroyd 1990; Stafford 1990). Geikie (1875, vol. 1,

pp. 356–357) sought to explain Murchison's demeanour and character:

He had hitherto been, as it were, one of the captains of a regiment; he now felt himself entitled to assume the authority of a general of division. To many men who did not know him, or who knew him only slightly, this tendency assumed an air of arrogance, and was resented as an unwarranted assumption of superiority [...] Yet underneath those outer and rather forbidding peculiarities lay a generous and sympathetic nature which inspired many an act of unsolicited and unexpected kindness, and which was known to refuse to be alienated even after the deepest ingratitude.

Collie & Diemer (1995, p. 98) note Murchison's well-known arrogance and pomposity, and wonder that, 'During the ensuing decade as Murchison and Geikie spent more and more time together, the latter's loyalty and forbearance were remarkable'.

### *Geikia*

In light of Geikie's only passing interest in the Elgin Permo-Triassic sandstones, it might seem surprising that one of the Elgin reptiles became the leading fossil named after him, in the sense that this was the only genus (rather than a species) honouring his name. This was *Geikia*, the genus name established by Newton (1892, 1893), and later to be enhanced by being translated into the Subfamily Geikiinae, named by Nopcsa (1923), and elevated to Family Geikiidae by Huene (1948). Who was Newton, and why did he name the reptile after Geikie? Did Geikie somehow insist that his subordinate, Newton, did this? Is there anything to be noted from the fact that Newton was elected to the Fellowship of the Royal Society in June 1893, the year in which he named *Geikia*?

Edwin Tulley Newton (1840–1930) was a palaeontologist employed by the Geological Survey. He had been trained by Thomas Huxley, 'my respected master in science' (Newton 1893, p. 449), by attending his lectures at the Royal School of Mines in London, precursor of Imperial College, and was then appointed as his assistant in 1865. Huxley at the time was naturalist to the Geological Survey. Through Huxley's influence, Newton became palaeontologist to the Geological Survey, whose Museum of Practical Geology was then located in Jermyn Street, London, together with the Royal School of Mines. The School moved to its current site in South Kensington in 1872, but the Geological Museum moved from Jermyn Street to a new building in Exhibition Road only in 1935. Newton held the role of palaeontologist from 1882 to 1905. The most useful biography of Newton is Woodward (1932), written as an obituary and, interestingly, the first in the new series on deceased Fellows of the Royal Society. In the Geikie archives in

Edinburgh and Haslemere, we found only one letter between Newton and Geikie, this a sick note dated '9th February, 1894' in which Newton formally reported a bout of influenza and excused his absence from the Museum (Edinburgh University Library GB 237 Coll-74, box of unnumbered letters).

The purpose of Newton's (1892, 1893) papers was to present a new fauna of dicynodonts and a pariasaur, typical elements of latest Permian faunas, from the yellow sandstones of the Cutties Hillock Quarry, west of Elgin. The name *Geikia* was introduced to the world first in an abstract (Newton 1892, p. 390), and then in the full monograph (Newton 1893, p. 466). The full name, *Geikia elginensis*, was given to a skull of a dicynodont from Morayshire, similar to *Lystrosaurus* from the latest Permian and Early Triassic of the Karoo, South Africa (Rowe 1980; Maisch & Gebauer 2005). This skull (Geological Survey Museum 90998-91015) differed from the other Elgin dicynodonts, named as various species of *Gordonia* in the same paper, in being exceptionally short-snouted, and so worthy of separation as a distinct genus (Fig. 1).

Newton's paper was received on 28 November 1892 and read on 15 December 1892. It is interesting to note that the paper was 'communicated by Sir Archibald Geikie, For. Sec. R.S.'. This is not, however, perhaps so surprising. When he submitted the paper, Newton was not a Fellow of the Royal Society, and so his work had to be presented by an existing FRS, and it is reasonable that the Director of the Geological Survey would present the work of his subordinate.

Newton (1893, p. 434) wrote about his commission in the paper:

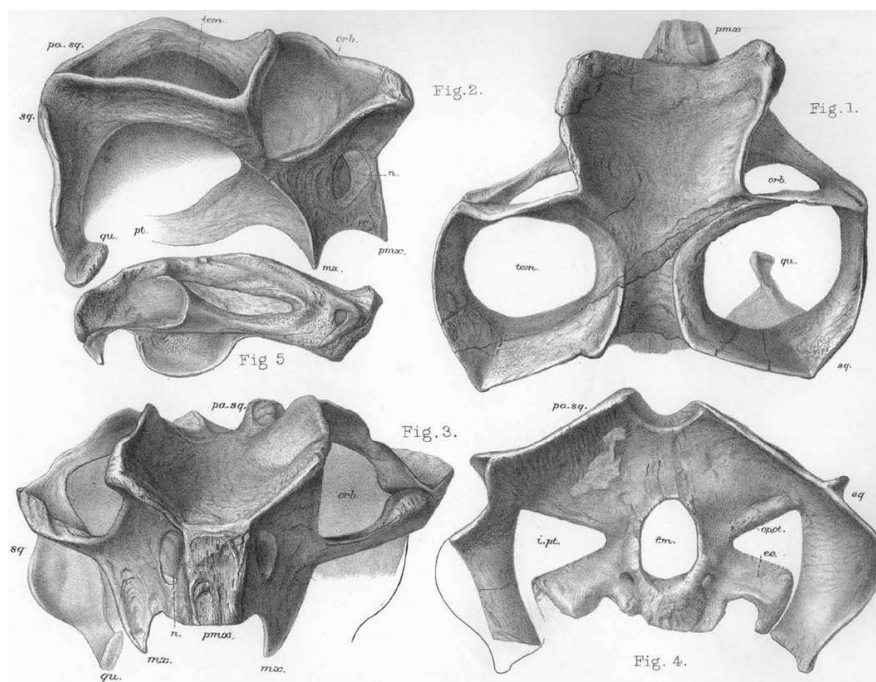
My colleague, Mr. J. HORNE, pointed out the desirability of these specimens being definitely determined, and, at the desire of Sir ARCHIBALD GEIKIE, the Director-General of the Geological Survey, I undertook the task of working out these fossil remains. The results of this investigation form the subject of the present communication.

Later (Newton 1893, p. 436), he noted, in reference to the new species *Gordonia traquairi*:

I had already developed and described the remains included in the first consignment of the Elgin Museum specimens, when Sir ARCHIBALD GEIKIE desired me to include with them the description of the Survey examples, at that time in Edinburgh, which proved to be of great service in clearing up certain difficulties, more especially in the interpretation of parts of the skull.

He explained the choice of the name *Geikia* (Newton 1893, p. 470) as follows:

I propose to associate it with the name of Sir ARCHIBALD GEIKIE, the Director-General of the Geological Survey, while specifically it will be convenient to



**Fig. 1.** Illustration of the type specimen of *Geikia elginensis* (Newton 1893, pl. 36; Geological Survey Museum 90998–91015). A skull seen in: 1, dorsal; 2, right lateral; 3, anterior; 4, occipital views; and 5, lower jaw from the left side, in medial view.

suggest the neighbourhood where the specimen was found: it will therefore be known as *Geikia Elginensis*.

Newton was not averse to naming his new taxa after people. For example, in the same 1893 paper, he honoured six Scottish worthies, all people who had been closely associated with work on the Morayshire rocks and their contained fossils: the Rev. Dr George Gordon (1801–93) in the genus name *Gordonia*; Ramsay H. Traquair (1840–1912) in the species *Gordonia traquairi*; Thomas Huxley in the species *Gordonia huxleyana*; Patrick Duff (1791–1881) in the species *Gordonia duffiana*; John W. Judd (1840–1916) in the species *Gordonia juddi*; and, of course, Archibald Geikie in the genus name *Geikia*. The final reptile in the 1893 paper, a pareiasaur, was named *Elginia mirabilis*, perhaps because it was so astonishing with its strange, spiky skull, or because Newton had exhausted his stock of people to be honoured. Note, however, there was no honour for Murchison!

As Woodward (1932, p. 5) explained:

Newton's chief official duty as palaeontologist to the Geological Survey was the naming of the fossils

collected and the preparation of lists of these fossils for the memoirs which accompanied the maps.

The scope of his published studies was wide, encompassing Carboniferous plants, Jurassic pterosaurs, Cretaceous fishes, and Cenozoic reptiles, birds and mammals. He was elected FRS in 1893, in parallel with his presentation of the Elgin reptiles to that society, and he held various senior offices in professional societies. However, Geikie was not one of his proposers (his proposers for election as FRS were J.W. Hulke, W.H. Flower, H.G. Seeley, P.L. Sclater, W.T. Blanford, W. Whitaker, Edward Hull, Henry Hicks, J.J.H. Teall, William Topley, W.H. Hudleston, Henry Woodward, Thomas H. Huxley, St George Mivart, T.G. Bonney, T. Rupert Jones, W. Boyd Dawkins and C. Le Neve Foster: the case was first put forward in December 1890). Woodward (1932, p. 7) concluded concerning Newton:

His charming personality, unassuming and kindly, caused him to be held in high esteem both by colleagues and friends; and his helpful disposition will be remembered by the younger generation who are indebted to him.

There is no evidence that Geikie exerted any pressure on his junior at all. Newton honoured several key researchers in naming the Cutties Hillock reptiles – some, such as Huxley and Geikie, people to whom he owed a debt of gratitude; others, such as Duff whom he might never have met; and those (Traquair and Judd) who were his exact contemporaries. Interestingly, Geikie barely mentioned *Geikia* in his own writings. There is no reference in his autobiography (Geikie 1924), where Geikie does not shrink from highlighting his numerous honours and awards, although he does not mention any others of the taxa named in his honour. In his rather daunting *Text-book of Geology*, Geikie (1903, p. 1090) mentions *Geikia* in passing, but with no special comment among a list of the other Elgin reptiles and clear statements about the Triassic age of the sandstones. He does say the reptiles were, ‘skilfully worked out and described by Mr E.T. NEWTON of the Geological Survey’. The name *Geikia* is mis-spelt *Geikia* in the index (Geikie 1903, p. 1432).

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