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Sydney Basin in the Triassic—a review of the geology, flora and fauna, and ecosystems. The Wianamatta Group

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Abstract. As the town of Sydney grew in the 1800's the search for building material and the later construction of railways in the colony revealed an extensive trove of Triassic fossils. Many were passed to and held in scientific collections to later be described. The Australian Museum was one of the institutions which progressively built an extensive and diverse collection of this material. Drawing primarily on these resources, this study reviewed all known flora and fauna of the Middle Triassic Wianamatta Group of the Sydney Basin. Each taxon is illustrated, and a brief taxonomic history is included. To allow efficient access to specimens, museum registration numbers are listed and specimens' positions in the collection noted. The range of the known biodiversity encompasses three temnospondyls, twelve fishes, fourteen insects, five crustaceans, two molluscs and two plants recovered from different sites across the basin. In some cases, this study also includes specimens and images from the Geological Survey of New South Wales, the Queensland Museum and the Natural History Museum, London. To place the collection in context, particularly for educators working with students, a brief geological description and inferred ecosystems of the Wianamatta Group are included.

Introduction

The Triassic rock succession of the Sydney Basin comprises three major divisions: the Narrabeen Group, the Hawkesbury Sandstone and the Wianamatta Group. Previous studies have covered the Narrabeen Group (McLean, 2023) and the Hawkesbury Sandstone (McLean, 2024). The Wianamatta Group is the final Triassic depositional episode of the Sydney Basin. The sedimentary succession of this major regression includes shoreline and alluvial sedimentary layers. Meandering streams flowed down from the northwest forming flood outwash basins, levees and backswamps (Herbert, 1980a). Shales, formed by the lagoonal and peat marsh environments of this Middle Triassic time, have been quarried, and transport infrastructure cuttings were often driven through the Wianamatta shales. These activities revealed fossils, many of which are now housed in the Australian Museum.

The aims of this study were to: 1) summarise the geological construction of the Wianamatta Group, 2) provide details of all plant and animal fossil taxa discovered within the region, 3) provide details of the collection locations, and 4) make inferences about the palaeoecosystems within the region based on the flora and fauna discovered so far.

The initial section of this report is a brief summary of the geology of the Wianamatta Group. The core section of this report, "Flora and Fauna", is a summary description of every taxon described or identified in the Wianamatta Group fossil collection of the Australian Museum, as well as of the Geological Survey of New South Wales, the Queensland Museum and the Natural History Museum, London. An image of each taxon is included. The fauna of this time ranges from the vertebrates (amphibians and fishes), to the invertebrates (insects, other arthropods, crustaceans and molluscs). The flora includes lycopsids, horsetails, seed ferns, ferns and conifers.

Keywords: Sydney Basin, Triassic; Wianamatta Group; fossil sites; fossil fish; fossil plants; fossil insects; temnospondyl; crustacean, mollusc
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This report has been designed to be used by scientists and educators as a reference guide to the geology, life and environment that existed during the time of the Wianamatta Group deposition.

Methods

Explanation of abbreviations

AM—Australian Museum.

AM F.nnnn—Australian Museum fossil specimen registration number; a slash denotes part/counterpart specimen registration numbers.

AMGC—Australian Museum General Collection (Palaeontology).

AMTC—Australian Museum Type Collection (Palaeontology).

BDnn—Benjamin Dunstan private collection registration number.

Fig., Figs—Figures in this paper.

fig., figs—Figures in cited papers.

GSNSW—Geological Survey of New South Wales, Londonderry.

GSQ—Geological Survey of Queensland.

GSQnn—Geological Survey of Queensland specimen registration number (specimens now absorbed into the Queensland Museum collection at Hendra).

MF nnn—Transfer specimen registration number for transfer between the Mining and Minerals Museum and the Australian Museum.

MM—Mining and Minerals Museum (now absorbed into the GSNSW collection at Londonderry).

MMF nnnn—Mining and Minerals Museum fossil specimen registration number (specimens now in the Geological Survey of New South Wales collection at Londonderry).

NHMUK—Natural History Museum, London.

pl.—Plate in cited paper.

QM—Queensland Museum.

QMF nnnn—Queensland Museum fossil specimen registration number.

SUP nnnn—University of Sydney Palaeontology specimen registration number.

#—Specimen registration number not yet matched to figured specimen in collection records.

¿—Specimen number unable to be matched to mentioned specimen as no identification is evident in collection records.

“ surname/ year/subscript”—Indicates a physical label fixed to a drawer in the AMTC. e.g. “ Stephens 1887c”. They are not references in the context of this report.

Taxonomic conventions used

Identification of individual fossils from the Sydney Basin within a taxonomic framework has, in many cases, been subject to multiple changes, particularly among the plants. In this review the reason for each change is discussed under the appropriate taxon. Synonymy lists cite only emendations to taxonomic status. They do not include any papers where authors have used the nominated taxonomy without change.

In this study an attempt was made to provide all names that have been applied to Sydney Basin fossils and to use the name most recently considered valid. It is not the intention of this study to offer any new taxonomic interpretations, new names, new combinations, new spellings, or new synonyms. Where taxonomic emendments have been made to genera and/or species based on similar specimens from another region, this has usually been noted within the relevant discussion of the relevant species. Unless the author promoting the change in the other region specifically noted that it applied also to the Sydney Basin species, the change has not been applied to the Sydney Basin species binomial taxonomic description in this document. For higher taxonomic levels the most recent consensus view has been applied.

Type material conventions

Type material refers to nominated types (holotype, paratype, neotype, syntype, lectotype or paralectotype) as well as specimens figured or mentioned in the relevant peer reviewed journals. This follows the convention used in the AMTC where nominated types, figured and mentioned specimens are held within the Type Collection. Nominated types include specimens from any site, but specimens which were figured or mentioned are only from the nominated site under discussion.

GEOLOGY

The Sydney Basin structure

The Sydney Basin is the southern-most extension of a longitudinal chain of basins which includes the Bowen Basin in eastern Queensland and the Gunnedah Basin of northeastern New South Wales. The basin outcrops from Durras in the south to the Hunter Valley in the north, and its western edge runs along the western side of the Blue Mountains. Its total area is approximately 52,000 square kms, of which 15,000 square kms is offshore (Alder *et al*., 1998; McLean, 2023; Fig. 1).

Triassic deposits within the Sydney basin are broadly divided into three major sedimentary divisions, each marking major changes in deposition. The Narrabeen Group is the stratigraphically lowest, with the Hawkesbury Sandstone overlying it, and the Wianamatta Group at the top of the sequence. The Mittagong Formation is a thin intermediary deposit between the Hawkesbury Sandstone and the Wianamatta Group. Further details of the Sydney Basin structure are summarised in McLean (2023).

Stratigraphy and sedimentation

The Wianamatta Group is the uppermost Triassic deposit within the Sydney Basin. It occupies only the central portion of the basin, hence outcrop is limited. Most of the stratigraphic data comes from drill core, cuttings and brick quarries. There are two main areas of outcrop, the major one forms the central Cumberland Plain west of Sydney, while a smaller one appears south-west of the Wollongong area (Fig. 2). Deposition occurred during a regression event (Herbert, 1980a), with sedimentation ceasing in the Middle Triassic (Helby, 1973). Sediments largely originated from the northwest, and were carried by meandering streams into flood basins and back swamps. These formed marshy

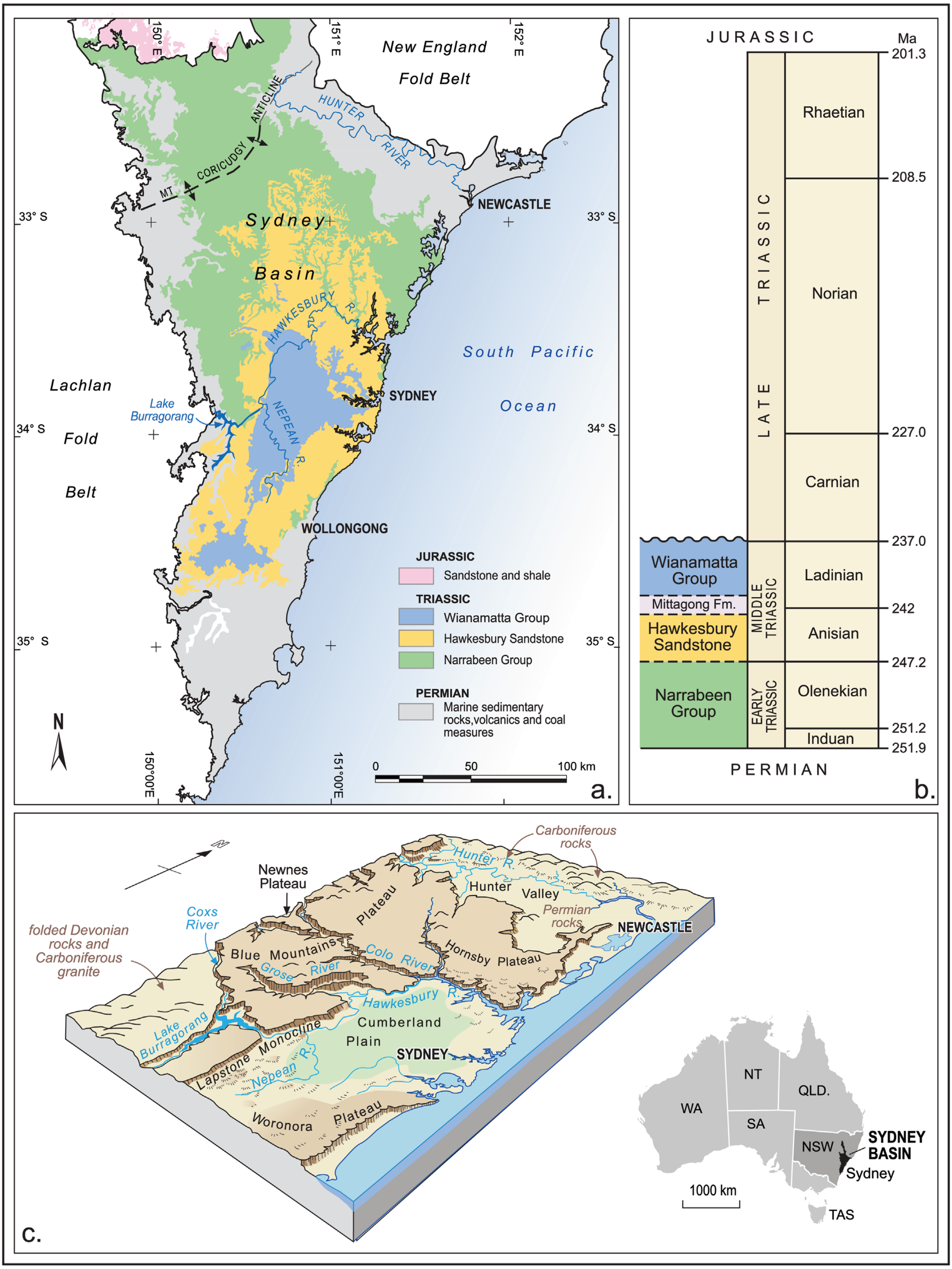

Figure 1. Sydney Basin structure. (*a*) Outcrop map of the three Triassic divisions in the Sydney Basin. (*b*) Stratigraphic relationships of these three Triassic divisions. (*c*) Three-dimensional model of the central and northern sections of the Sydney Basin. Artwork by Dean Oliver. Taken from McLean (2023).

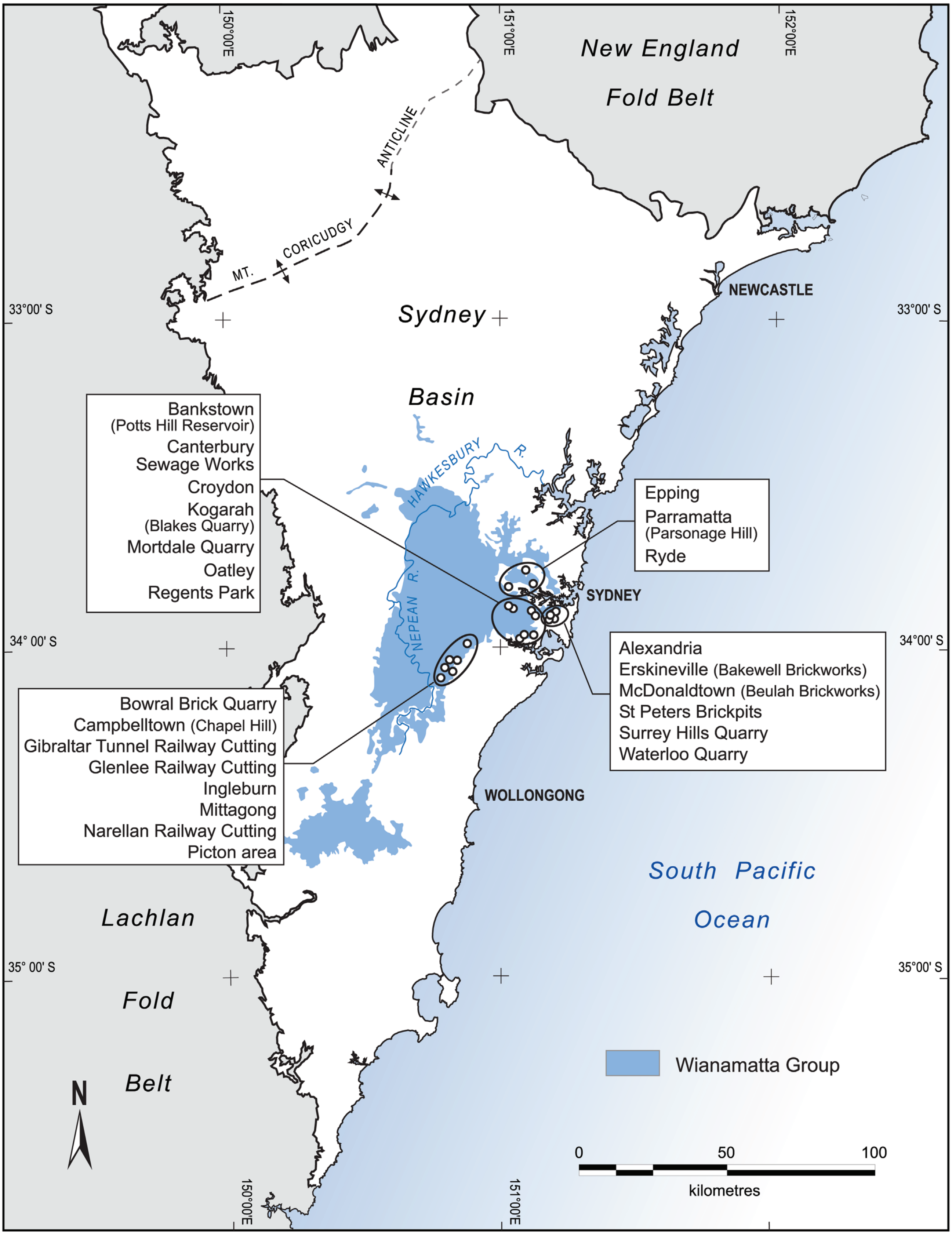

Figure 2. Wianamatta Group outcrops and fossil sites. Artwork by Dean Oliver.

lagoons behind coastal sand barriers and islands (Herbert, 1980a). The group can be subdivided into three stratigraphic units, the Ashfield Shale, the Minchinbury Sandstone and the Bringelly Shale, in ascending stratigraphic order.

The Ashfield Shale is composed of dark grey sideritic claystone, siltstone and fine-grained sandstone. The lower portion largely consist of dark grey claystone and siltstone laminites (Fig. 3a–b) which grade up into lighter coloured, thicker sandstone beds (Herbert, 1980b). Measured boreholes indicate a minimum thickness of 44.6 m in the Picton area increasing to a maximum of 61.6 m near Erskine Park (Herbert, 1980b). It comprises four members, the Rouse Hill Siltstone, Kellyville Laminite, Regentville Siltstone, and Mulgoa Laminite (Herbert, 1979). Fossil fauna from the lower levels of the Ashfield Shale suggest deposition within a freshwater lake environment, whilst ripple marks and marine estuarine fossils advocate the upper levels had a greater marine influence (Herbert, 1980b).

The Minchinbury Sandstone lies between the Ashfield Shale and overlying Bringelly Shale. It is highly quartzose, with argillaceous and volcanic lithic fragments together with rare calcite and feldspar (Herbert, 1980b). The unit is usually 3 m thick or less, however, occasionally it reaches 6 m at some locations (Herbert, 1980b). Low angle crossbedding suggests a coastal deposit or an offshore bar, potentially part of a beach and barrier system (Herbert, 1980b).

The Bringelly Shale is composed of a dominant claystone and siltstone component, with minor sandstone and tuff horizons. It has been measured as 257 m thick in the Razorback Range, although generally is thinner. The unit contains Cobbity Claystone Bed, the Potts Hill Sandstone Member, the Razorback Sandstone Member (Fig. 3d), and the Mount Hercules Sandstone Member (Herbert, 1980b). Frequent repeated laminites of leached and carbonaceous claystone suggest alluvial overbank to waterlogged swamps were common setting. Overbank sediments and channel sandstones indicate much of the Bringelly Shale formed in sinuous streams adjacent to flood basins, probably ending in coastal lagoons (Herbert, 1980b).

Palaeotopography

Fossils extracted from the Ashfield Shale Formation indicate freshwater lake environments existed at different times and places. High in the formation an increased sand content and current ripples suggest delta front conditions (Herbert, 1980b). The Minchinbury Sandstone separates the shallow water Ashfield Shale from the alluvial plain deposits of the higher Bringelly Shale, indicating it was a strandline deposit. Crossbedding suggests beach or sandbar deposition, with onshore wave action from the east (Herbert, 1980b). The Bringelly Shale Formation includes alternating claystone, siltstone and laminites. These are interpreted as coastal, alluvial plain successions, ranging from coastal lagoons and marshes through increasingly terrestrial surfaces to alluvial plain sediments (Herbert, 1980b).

Fossiliferous deposits

The shales of the Wianamatta Group have been excavated extensively for brick manufacture (Herbert, 1979). In the early years of these quarrying activities many fossils were discovered, finding their way into the scientific collections of the Australian Museum, the Geological Survey of New South Wales, the Queensland Museum and the Natural History Museum of London from a range of sites (Fig. 2).

FLORA AND FAUNA

Fossils have been recovered from one major site and numerous minor sites within the Wianamatta Group. The major site was a group of brickpits in St Peters that produced a large temnospondyl, many species of fishes, some insects, crustaceans, molluscs and plants. Historically, and more recently, the Bowral Brickpits have yielded fragments of temnospondyl and some fishes, while railway cuttings have unearthed molluscs, insects, crustaceans and plants. Other brickpits scattered around Sydney have exposed plants, fishes and molluscs (Fig. 2). This study does not cover data on microfossils such as algae, foraminifera, spores and pollen.

St. Peters Brickpits

The St. Peters brickpits sites comprised seven separate but geographically close and geologically similar quarries, all within the inner-city suburbs of Sydney, grouped around St. Peters. All are now closed and have been filled in, making them inaccessible. The brickpits included Carrington, Federal, Gentle's, Harper's Newtown, Jubilee, Vickery's and Woodleigh's. Specimens were collected over a period of approximately 40 years before closure (Wade, 1941a).

Benjamin Dunstan (1864–1933), while a lecturer in Geology, Mineralogy and Mining at the Sydney Technical College, collected a range of fossil flora and fauna from the St Peters brickpits. He forwarded the fish specimens to Sir Arthur Smith Woodward (1864–1944) of the British Museum for taxonomic study. Woodward published the first paper on the fish specimens of the Wianamatta Group (Woodward, 1908). Later, in Sydney, the Very Rev. Dr. R.T. Wade updated the taxonomy of some of these specimens (Wade, 1941a). During his search in the St. Peters brickpits Dunstan discovered a large nodule that contained the complete skeleton of a temnospondyl. Rix (2023) details the movements and ownership of this specimen which was sold to the British Museum (now the NHM) in 1927. It was later described by Watson (1958) as *Paracyclotosaurus davidi*.

Class Amphibia Gray, 1825

Order Temnospondyli Zittel, 1888 (in Zittel, 1887–1890)

Superfamily Mastodonsauroidea Lydekker, 1885

Family Mastodonsauridae Lydekker, 1885

Paracyclotosaurus davidi Watson, 1958

Figs 4a–c

Holotype: NHMUK R6000 (Figs 4a–b)—part and counterpart—held in the NHMUK collection.

This 2.25 metre long specimen was found in a large ironstone nodule by Dunstan some time before 1910 (Rix 2023). It was broken into sections and shipped to the Natural History Museum London, where over decades the specimen was reconstructed (Watson, 1958). It represents a complete articulated skeleton that is now exhibited at the NHMUK. Watson (1958) placed this species in the Capitosauridae of the Capitosauroidea. The head length was measured at 0.6 metres, with the maximum body width approximately 0.5 metres, and the tail was 0.5 metres long (Fig. 4c). A cast of

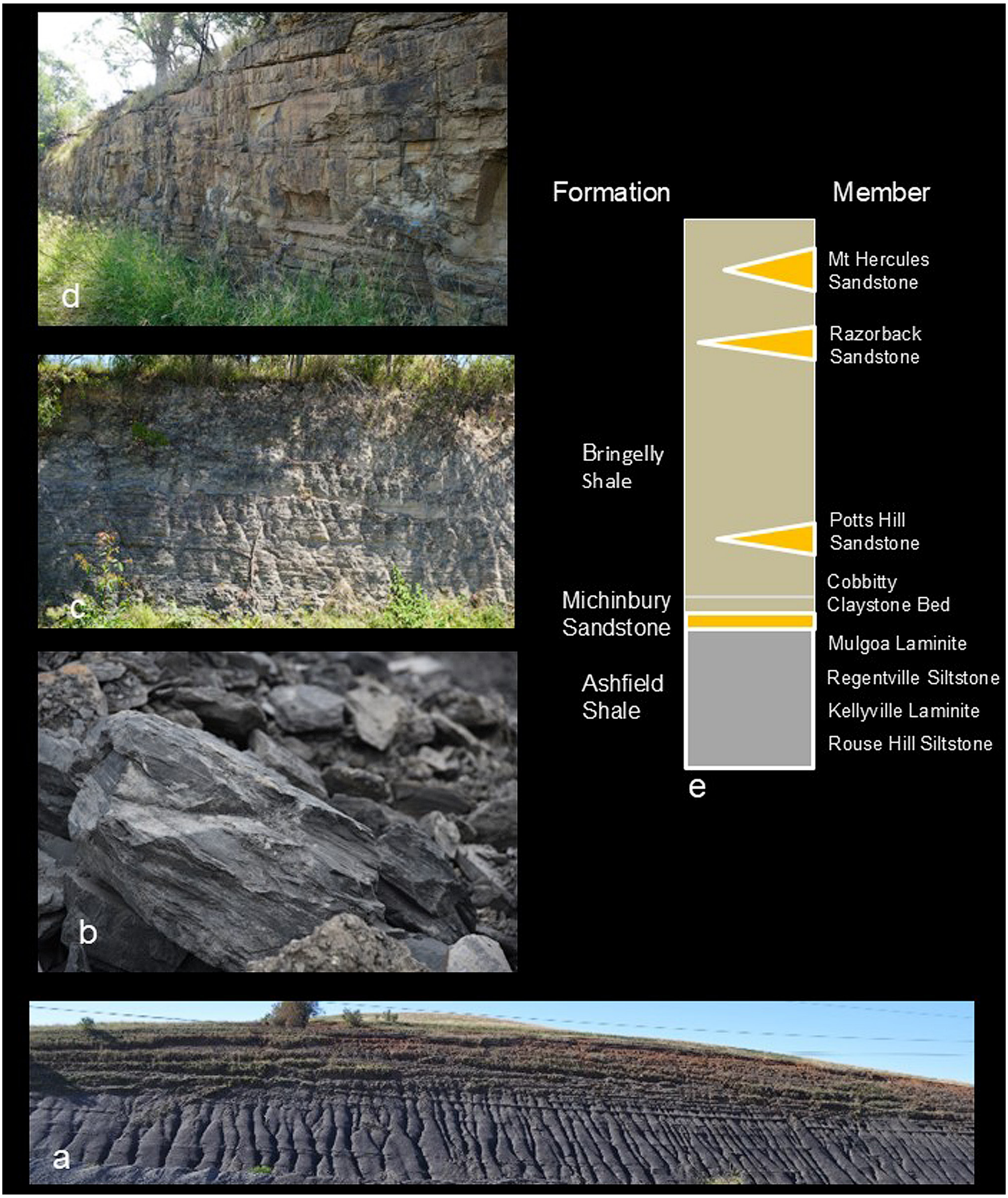

Figure 3. Wianamatta Group Road cutting exposures and lithostratographic column. (*a*) Dark eroded lower-level Ashfield Shale in a Picton Rd cutting. (*b*) Ashfield Shale exposed during excavation on the corner of Marco Ave and Anderson Ave, Panania. Photo by Ross Pogson. (*c*) Light upper-level Ashfield Shale exposed in a St Ives Horace Rd cutting. (*d*) Bringelly Shale sandstone member exposed in a Mt Razorback Road cutting near Picton. (*e*) Simplified lithostratographic column of the Wianamatta Group.

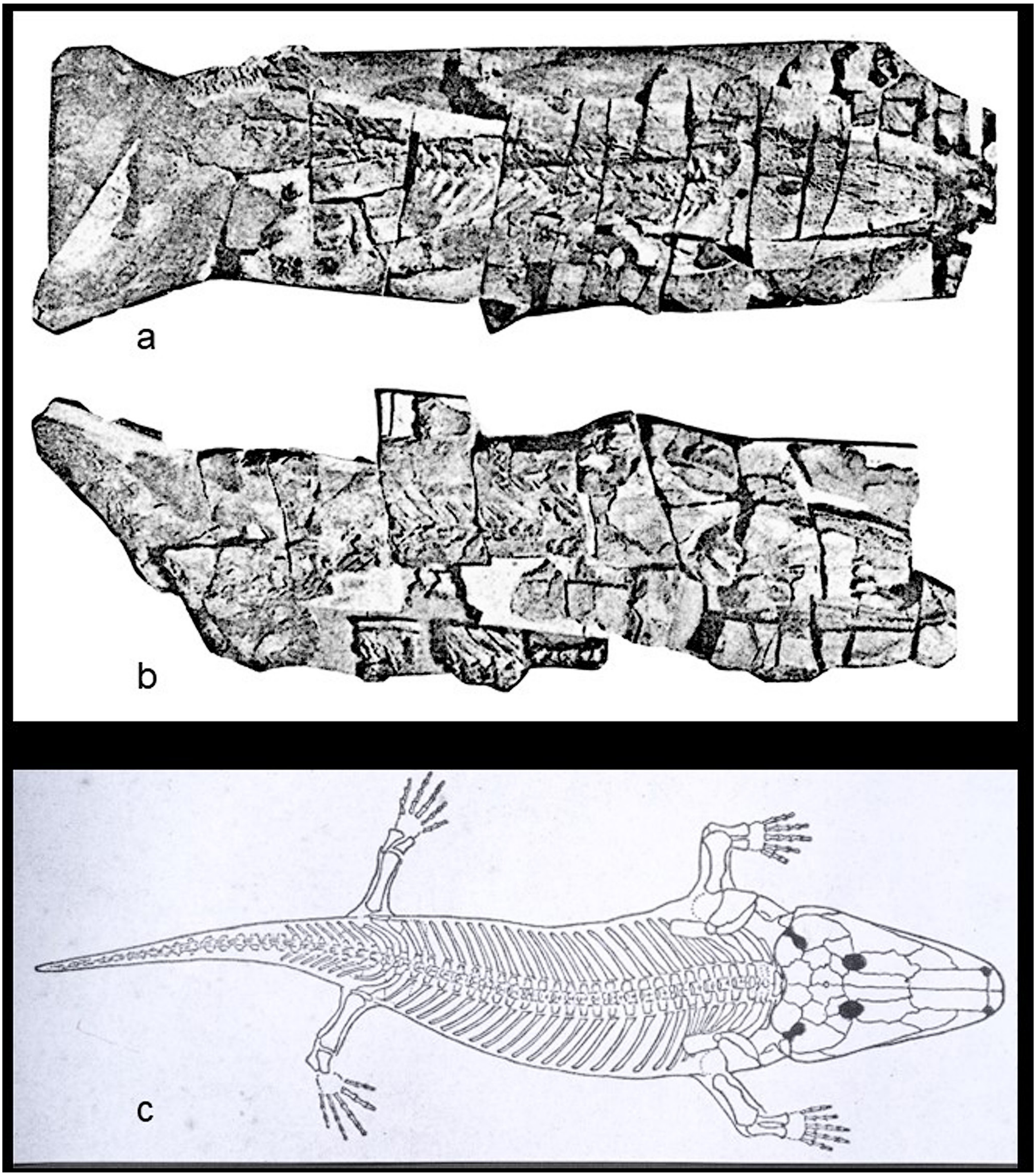

Figure 4. Fossil from St Peters brickpits. Amphibia. (*a*) NHMUK R6000. *Paracyclotosaurus davidi*. Part. (*b*) NHMUK R6000. *Paracyclotosaurus davidi*. Counterpart. (*c*) *Paracyclotosaurus davidi*. Dorsal view reconstruction. *a,b,c* reproduced from Watson (1958) with permission of the Trustees of the Natural History Museum, London.

the same specimen (which has been partially reconstructed) is held at the Discovery Centre in Castle Hill New South Wales by the Australian Museum.

As a result of a new cladistics analysis, Damiani (2001) replaced Capitosauroidea with Mastodonsauroidea and merged Capitosauridae into Mastodonsauridae. Damiani (2001) drew attention to several detailed character anomalies in the cast and original diagrams of the skull roof of the type specimen. He commented that this could be caused by the historic cast preparation techniques, and that newer casts of the specimen may provide important information. For further discussion of the history of this specimen, refer to Poropat *et al*. (2023).

Superfamily Brachyopoidea Lydekker, 1885

Family Brachyopidae Lydekker, 1885

Unnamed specimen—NHMUK R9586—ironstone fragment with skull—held in the NHMUK collection (pers. comm. Millner, 2012).
Brachyopid skull—Watson,1958: 259, fig. 16.
Brachyopiae indet—Warren and Marsicano, 1998: 339.

Watson (1958) reported the discovery of a large ironstone fragment containing the impression of a crushed brachyopid skull. Although many of the skull bones were identifiable, the remains were not generically determinable (Watson, 1958). Warren and Marsicano (1998) considered it was undoubtably a brachyopoid because of its deeply impressed lateral line canal and its downturned quadrate ramus of the pterygoid. They placed it in Brachyopidae.

Fishes

Original taxonomic work on St Peters fishes specimens collected by Dunstan was carried out by Woodward of the British Museum, London (Woodward, 1908). In 1935, Ada May Dunstan sold many fossil specimens from her late husband's collection to the British Museum (now the NHM), amongst which were fish specimens from the St Peters brickpits (Rix, 2021). Later, Wade reviewed the work of Woodward and updated the taxonomy of three genera, erecting a new family to accommodate them (Wade, 1941a).

Class Chondrichthyes Huxley, 1880

Subclass Elasmobranchii Bonaparte, 1838

Order Xenacanthiformes Berg, 1955

Family Xenacanthidae Frič, 1889

Mooreodontus parvidens (Woodward, 1908)

Fig. 5a

Pleuracanthus parvidens Woodward, 1908: 2, pl. 1 figs 1–8.
Xenacanthus parvidens.—Johnson, 1980: 930.

Type: MMF 13430 (Fig. 5a) (pl. 1 fig. 1)—nearly complete fish 1.43 m long with spine partly shown in impression—held in the GSNSW collection.
Figured: MMF 13414 (pl. 1 fig. 2)—imperfect jaws—held in the GSNSW collection. # (pl. 1 fig. 3)—portion of jaws with teeth, # (pl. 1 figs 4–5)—group of teeth—possibly held in the GSNSW collection. MMF 13431 (pl. 1 fig. 6)—fragment of abdomen—held in the GSNSW collection. MMF 13415 (pl. 1 fig. 7)—pectoral fin—missing from GSNSW collection. # (pl. 1 fig. 8)—pair of pectoral fins—possibly held in GSNSW collection.
Mentioned: ¿—portion of head and dentition—possibly held in the GSNSW collection.

These specimens were found at four different brickpits. The type specimen is the largest nearly complete *"Pleuracanthus"* discovered at that time (Woodward, 1908). Woodward placed these specimens within the Pleurocanthidae in the Ichthyotomi. Johnson (1980), while discussing the comparative structures of xenacanthid teeth, re-assigned "*Pleurocanthus" parvidens* to *Xenacanthus*. Ginter *et al.* (2010) re-assigned "*Pleurocanthus" parvidens* to *Mooreodontus* because of the morphological similarity of its teeth to other *Mooreodontus* species from Brazil, Europe and the USA.

Class Sarcopterygii Romer, 1955

Subclass Dipnoi Müller, 1845

Order Ceratodontiformes Berg, 1940

Family Ceratodontidae Günther, 1871

Archaeoceratodus avus (Woodward, 1906)

Fig. 5b

Ceratodus avus Woodward, 1906: 2–3, pl. 2 fig. 1—synonymised by Kemp, 1997.
Sagenodus laticeps Woodward,1908: 6, pl. 2 figs 1–2—synonymised by Kemp, 1997.
Ceratodus laticeps.—Wade,1931: 123—synonymised by Kemp, 1997.
Archaeoceratodus avus.—Kemp, 1997: 728.

Type: MV P10057—incomplete left lower toothplate—Woodward (1906)—held in Museum Victoria.
Figured: MMF 24788 (Fig. 5b) (pl. 2 figs 1–1a)—incomplete skeleton—nominated as the *Sagenodus laticeps* type specimen by Woodward (1908)—lost. MMF 13460 (pl. 2 fig. 2)—scale—held in the GSNSW collection.
Other specimens: Several fragmentary and scale specimens sold by Mrs Dunstan in 1935 are held in the NHMUK. These include P18075—tail, P18076—scale, P18077—scale, P18078—scale, P18079—scale, P18094B—posterior end of trunk.

Woodward (1908) originally described MMF 24788 from St Peters brickpits as the holotype of a new species *Sagenodus laticeps*. The specimen is incomplete with the head distorted. Only part of the dorsal fin is preserved. Each dental plate consists of 4 acute ridges (Woodward, 1908). Woodward noted that the squamation closely resembles that of *Sagenodus*, which at that time was within the Ctenodontidae of the Sirenoidei. Wade (1931) placed this species in *Ceratodus*, as the site was subsequently confirmed to be Triassic, not Permian as Woodward (1908) thought.

Kemp (1997) stated that, although MMF 24788 is incomplete and damaged, sufficient characters, such as the shape of the bone base of the upper toothplate, closely resembled the shape of the lower tooth base of the specimen from Victoria described by Woodward (1906) as *Ceratodus avus*. Kemp (1997) erected *Achaeoceratodus* to include three Tertiary species and this Mesozoic species. This meant that the original holotype specimen MMF 24788 became a figured specimen of *Archaeoceratodus avus*, and the specimen described by Woodward (1906) retained its holotype status.

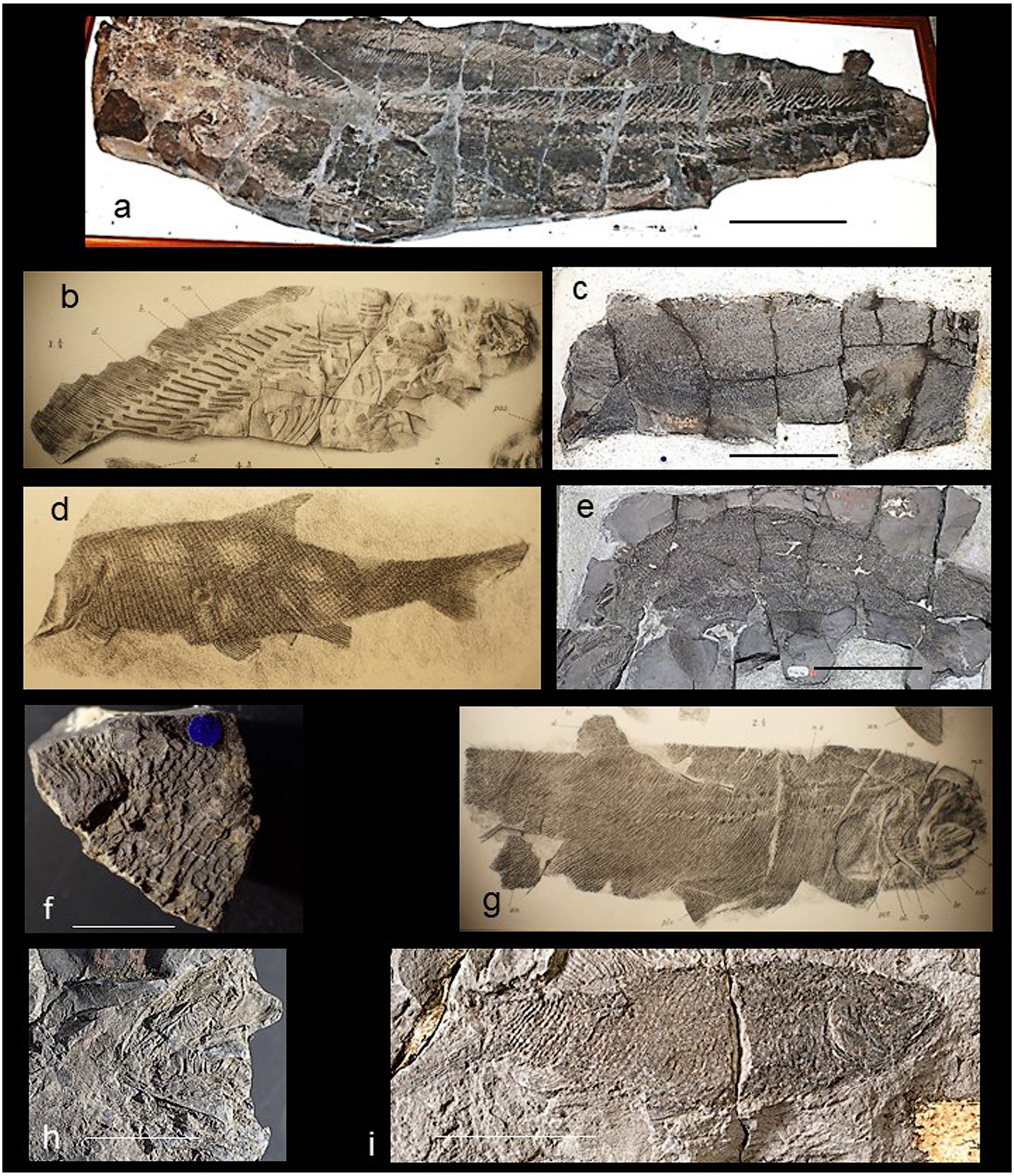

Figure 5. Fossils from St Peters brickpits. Fishes. (*a*) MMF 13430. *Xenacanthus parvidens*. (*b*) MMF 24788. *Archaeoceratodus avus*. (*c*) MMF 13478. *Palaeoniscus crassus*. (*d*) *Palaeoniscus antipodeus.* (*e*) MMF 13477. *Elochnichthys armatus*. (*f*) MMF 13455. *Elochnichthys semilineatus.* (*g*) MMF 13464. *Myriolepis pectonata*. (*h*) MMF 13454. *Elpisopholis dunstani.* (*i*) AM F.38905. *Promecosomina formosa. b,d,g* reproduced from Woodward (1908) © Geological Survey of NSW. Scale bars: *a* = 200 mm, *c,e* = 100 mm, *f,h* = 20 mm, *i* = 50 mm.

Class Actinopterygii sensu Goodrich,1930

Order Palaeonisciformes Hay, 1902

Family Palaeoniscidae Bonaparte, 1846

Palaeoniscus crassus Woodward, 1908

Fig. 5c

Type: MMF 13478 (Fig. 5c) (pl. 2 fig. 3)—incomplete at each end—held in the GSNSW collection.
Figured: MMF 13486 (pl. 2 fig. 4)—portion of dorsal region of trunk—held in the GSNSW collection.
Mentioned: #—internal cast of head (doubtful identification)—possibly held in the GSNSW collection.
Other specimens: AM F.17955/AM F.17951—held in the AMGC under "Pisces/Triassic/St Peters brickpits".

Woodward (1908) described these specimens as a new stout species about half a metre long. At that time Palaeoniscidae was within the Order Actinopterygii.

Palaeoniscus antipodeus Egerton, 1864

Fig. 5d

Type: fish without tail (photograph)—actual specimen lost—from Parsonage Hill, Parramatta—(Egerton, 1864).
Figured: (Fig. 5d) (Woodward, 1908: pl.4 fig.7)—fish without head—not registered in the GSNSW collection—lost.
Mentioned: ¿—distorted remains of head—possibly held in the GSNSW collection.

This species attained a length of 0.2 metres (Woodward, 1908). The poor preservation of generic characters of the two St Peters specimens meant there was doubt about their identification (Woodward, 1908).

Elonichthys armatus Woodward, 1908

Fig. 5e

Type: MMF 13477 (Fig. 5e) (pl. 3 fig. 1)—almost complete fish—held in the GSNSW collection.
Other specimens: AM F.41685—*Elonichthys* sp. held in the AMGC under "Pisces/Triassic/St Peters brickpits".

An elongated species about 0.65 metres long, with stout fin rays and large, thick scales (Woodward, 1908). *E. armatus* is distinguished from other species by the absence of serrations on the scales, and by coarse scale ornament (Woodward, 1908).

Elonichthys semilineatus Woodward, 1908

Fig. 5f

Type: MMF 13455 (Fig. 5f) (pl. 4 fig. 1)—middle portion of trunk—held in GSNSW collection.
Mentioned: ¿—distorted portion of larger trunk, ¿—greater portion of larger trunk—possibly held in GSNSW collection.

The specimens are fragmentary only. The species probably attained a length of 0.35 metres (Woodward, 1908). The fin rays are very stout, and the relative coarseness of the ornament on the anterior-superior portion of the scales distinguishes it from all other species (Woodward, 1908).

Myriolepis pectinata Woodward, 1908

Fig. 5g

Type: MMF 13464 (Fig. 5g) (pl. 3 fig. 2)—fish with tail missing –held in the GSNSW collection.
Figured: #—fragment of the abdominal region—possibly held in the GSNSW collection.
Mentioned: ¿—a fragment of the caudal region—possibly held in the GSNSW collection.
Other Specimens: Nine *Myriolepis* specimens held in the AMGC under "Pisces/Triassic/St Peters brickpits".

A stout species of length approximately 0.7 metres (Woodward 1908). This is the largest of the *Myriolepis*, and is closely related to *M. clarkei* (Woodward, 1908).

Elpisopholis dunstani Woodward, 1908

Fig. 5h

Type: # (pl. 4 fig. 2)—an imperfect fish—possibly held in the GSNSW collection.
Figured: MMF 13454 (Fig. 5h) (pl. 4 fig. 3)—remains of two heads—held in the GSNSW collection. # (pl. 4 fig. 5)—fragment of tail—possibly held in the GSNSW collection.
Mentioned: ¿—head and anterior portion of trunk, ¿—head in side view—possibly held in the GSNSW collection.

The type specimen is about 0.15 metres long (Woodward, 1908). The specimens were fragmentary and grouped together, possibly indicating they died in a shoal (Woodward, 1908).

Order Platysomiformes Aldinger, 1937

Family Platysomidae Young, 1866

Platysomus sp. Agassiz, 1833

The specimens from St Peters Brickpits comprise a few characteristic scales, with scale ornamentation similar to *P. tenuistriatus* from the Coal Measures of England, and are not sufficient for species identification (Woodward, 1908).

Order Perleidiformes Berg, 1937

Family Cleithrolepididae Wade, 1935

Cleithrolepis granulatus Egerton, 1864

Original specimen: ¿—Anterior half of fish from Cockatoo Island—not registered in the NHMUK collection—probably lost.
Lectotype (nominated by Wade (1935)): AM F.1471—complete fish from Cockatoo Island—held in the AMTC under "Egerton 1864".
Mentioned: Two specimens from St Peters brickpits—possibly held in the GSNSW collection.
Other specimens: Nine specimens held in the AMGC under "Pisces/Triassic/St Peters brickpits".

Two imperfect specimens were submitted to Woodward by J.E.Carne from the mudstones of St Peters brickpits (Woodward, 1908).

Subclass Neopterygii Regan, 1923

Order Parasemionotiformes Lehman, 1966

Family Promecosominidae Wade, 1941a

Promecosomina formosa (Woodward, 1908)

Fig. 5i

Semionotus formosus Woodward, 1908: 23, pl. 4 fig. 8—synonymised by Wade (1941a).
Pholidophorus australis Woodward, 1908. 26, pl. 4 fig. 9—synonymised by Wade (1941a).
Acentrophorus sp.—Woodward, 1908: 21, pl. 4 fig. 6.
Promecosomina beaconensis Wade, 1935: 80, text fig. 46, pl. 8 figs 3–4—synonymised by Wade (1941a).
Promecosomina formosa.—Wade, 1941a: 382, text figs 1–3, pl. 17.

Type: AM F.38905 (Fig. 5i) (Woodward, 1908: pl. 4 fig. 8)—complete fish, except for pectoral fins and part of caudal fin—held in the AMTC under "Woodward 1908" as *Semionotus formosus*.

Figured: # (Woodward 1908: pl. 4 fig. 9)—almost complete fish—possibly held in the GSNSW collection under *Pholidophorus australis*. MMF 13462 (Woodward 1908: pl .4 fig. 6)—fish without a head—held in the GSNSW collection under *Acentrophorus* sp.

Mentioned by Woodward (1908): ¿—a distorted, imperfect fish—possibly held in GSNSW collection under *Semionotus formosus*.

Mentioned by Wade (1941a): 22 specimens held in AMTC under "Wade 1941a". These are: AM F.17948, AM F.17954, AM F.29731, AM F.29718, AM F.29729, AM F.397, AM F.17953, AM F.3916 (4 specimens), AM F.14263 (slab with 9 individuals), AM F.148 (slab with 2 individuals).

Other Specimens: Two specimens held in the AMGC as *Semionotus* under "Pisces/Triassic/St Peters brickpits".

From amongst the specimens from the St Peters brickpits sites Woodward (1908) identified three genera from two different families; *Acentrophorus* and *Semionotus formosus* from the Semionotidae, as well as *Pholidophoridus australis* from the Pholidophoridae.

Wade (1941a) re-visited the taxonomy of these St Peters specimens, erecting the Promecosominidae, within the Holostei. This family exhibits a mix of Semionotidae and Eugnathidae characters (Wade 1941a). He re-assigned *Semionotus formosus*, *Pholidophorus australis* and *Acentrophorus* sp. from St Peters brickpits to this new family, as well as *Promecosomina beaconensis* (Wade, 1935) from Brookvale (Beacon Hill Quarry), and identified them all as specimens of a single species, *Promecosomina formosa* (Wade 1941a).

Class Insecta Linnaeus, 1758

Robin John Tillyard (1881-1937) published extensively on the insects of eastern Australia from 1916 to 1937. Rix (2021) published a comprehensive list of specimens described by Tillyard and Dunstan and these data have been incorporated in the descriptions below.

Order Blattodea Brunner von Wattenwyl, 1882

Family *incertae sedis*

Notoblattites subcostalis Tillyard & Dunstan, 1916

Figs 6a–b

Type: NHMUK In.33593 (BD25a)/GSQ25b (BD25b) (Fig. 6b)—part and counterpart from the Dunstan collection—complete individual with second partial specimen—In.33593 held in the NHMUK collection—GSQ25b held in the QM collection.

Co-type: NHMUK In.33301 (BD24a) (Fig. 6a)/GSQ24b (BD24b)—part and counterpart from the Dunstan collection—In.33301 held in the NHMUK collection—GSQ24b held in the QM collection.

Other specimens: Two specimens held in the AMGC under "Insect/Triassic/St Peters brickpits".

The type specimen of this cockroach is an almost complete individual in the rest position measuring 62 mm long and 34 mm wide, possibly a female. The co-type is a well preserved tegmen. This species appears to be closely allied to Carboniferous forms (Tillyard and Dunstan, 1916).

Order Coleoptera Linnaeus, 1758

Family Curculionidae Latreille, 1802

Etheridgea petrica Tillyard & Dunstan, 1916

Fig. 6c

Type: NHMUK In.33307 (BD31) (Fig. 6c)—from the Dunstan collection—small, distally pointed elytra—held in the NHMUK collection.

The type is nearly complete and broadly oval, with parts of both elytra missing (Tillyard and Dunstan, 1916).

Mesorhynchophora dunstani Tillyard & Dunstan, 1916

Fig. 6d

Type: NHMUK In.33303 (BD27a) (Fig. 6d)/GSQ27b (BD27b) part and counterpart from the Dunstan collection—an elytron—In.33303 held in the NHMUK collection—GSQ27b held in the QM collection.

The type elytron in part and counterpart is 15 m long and 5 mm wide, broad at the base and tapers to a narrow apex (Tillyard and Dunstan, 1916). Ponomarenko (2011) commented that this species should possibly be placed in Metrorhynchites within the Schizocoleidae.

Family Elateridae Leach, 1815

Elateridium wianamattensis (Tillyard & Dunstan, 1916)

Fig. 6e

Elaterites wianamattensis Tillyard and Dunstan, 1916: 41, pl .3 fig. 5.
Elateridium wianamattensis.—Tillyard, 1918a: 751.

Type: NHMUK In.33306 (BD30) (Fig. 6e)—from the

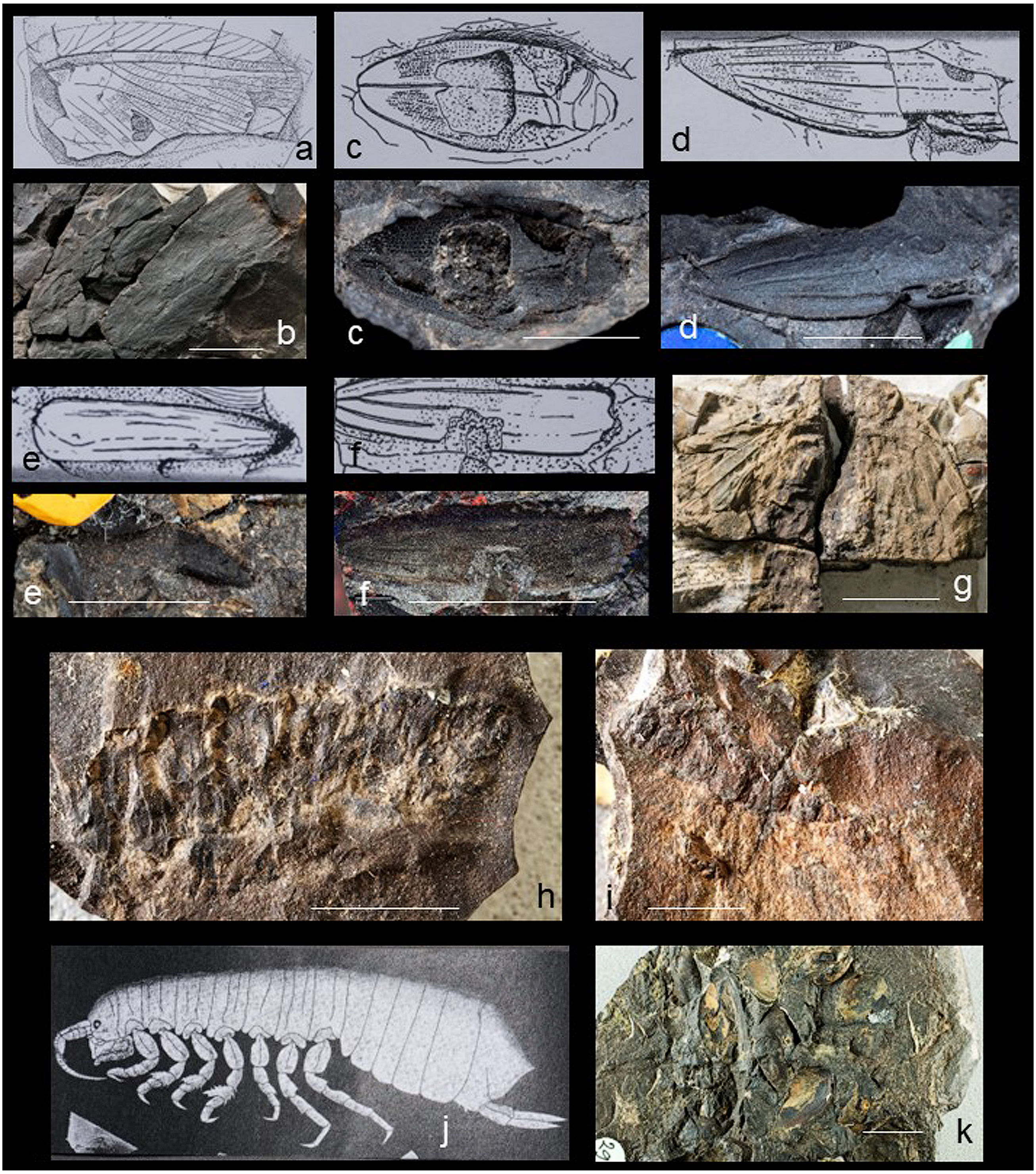

Figure 6. Fossils from St Peters brickpits. Insecta, Crustacea, Mollusca. (*a*) NHMUK In.33301. *Notoblattites subcostalis*. (*b*) GSQ 25b. *Notoblattites subcostalis*. (*c*) NHMUK In.33307. *Etheridgea petrica*. (*d*) NHMUK In.33303. *Mesorhynchophora dunstani*. (*e*) NHMUK In.33306. *Elateridium wianamattensis.* (*f*) GSQ 28a. *Metrorhynchites sydneiensis*. (*g*) GSQ 22a. *Mesotitan giganteus*. (*h*) AM F.49331. *Protamphiopus wianamattensis*. (*i*) AM F.49332. *Protamphiopus wianamattensis*. (*j*) *Protamphiopus wianamattensis*. Reconstruction from Wilson & Edgecombe (2003) © Cambridge University Press. (*k*) AM F.29745. *Protovirgus* assemblage*. c,d,e* images reproduced with the permission of the Trustees of the Natural History Museum, London. *b,f,g* images reproduced with the permission of the Queensland Museum. *a,c,d,e,f* artwork reproduced from Tillyard & Dunstan (1916) © Geological Survey of Queensland. Scale bars: *b* = 20 mm, *c,d,e,f,h,i* = 5 mm, g = 50 mm, k = 10 mm.

Dunstan collection—a small, elongate, oval elytron—held in the NHMUK collection.

Tillyard (Tillyard and Dunstan, 1916) chose the generic name *Elaterites* when naming this species, but later he renamed the genus *Elateridium* as he found that his first choice was pre-occupied (Tillyard, 1918a). The type elytron measures 6.5 mm with its greatest breadth 1.8 mm (Tillyard and Dunstan, 1916).

Family Schizocoleidae Rohdendorf, 1961

Metrorhynchites sydneiensis Tillyard & Dunstan, 1916

Fig. 6f

Type: GSQ28a (BD28a) (Fig. 6f)/NHMUK In.33304 (BD28b)—part and counterpart from the Dunstan collection—an oval, elongate elytron—GSQ28a held in the QM collection—In.33304 held in the NHMUK collection.

The type elytron in part and counterpart is 8 mm long and 2 mm broad, with three longitudinal ribs and a finely granular surface (Tillyard and Dunstan, 1916). Tillyard (Tillyard & Dunstan, 1916) placed this genus in the Malacodermidae. Later this genus was placed within the Schizocoleidae.

Order Titanoptera Sharov, 1968

Family Mesotitanidae Gorochov, 2003

Mesotitan giganteus Tillyard & Dunstan, 1916

Fig. 6g

Type: GSQ22a (BD22a) (Fig. 6g)/NHMUK In.33592 (BD22b)—part and counterpart from the Dunstan collection—GSQ22a held in the QM collection—In.33592 held in the NHMUK collection.

Mentioned: NHMUK In.33299 (BD21a)/GSQ21b (BD21b)—part and counterpart from the Dunstan collection—In.33299 held in the NHMUK collection—GSQ21b held in the QM collection. NHMUK In.33300 (BD23a)/GSQ23b (BD23b)—part and counterpart from the Dunstan collection—In.33300 held in the NHMUK collection—GSQ23b held in the QM collection.

The type specimen is very large, as the preserved part of the insect measures 125 mm long by 146 mm wide. The complete forewing could have been 220 mm long by 75 mm wide, making the complete insect about 500mm wingtip to wingtip (Tillyard & Dunstan, 1916). Gigantic insects of these dimensions had become extinct in the northern hemisphere by the end of the Palaeozoic Era (Tillyard & Dunstan, 1916). Tillyard and Dunstan (1916) placed this species within Protorthoptera without nominating a family.

There has been considerable discussion about the taxonomic position of this species, particularly its relationship to the other gigantic genus *Clatrotitan* from Brookvale (Beacon Hill Quarry) (Jell, 2004). Recent workers have considered *Mesotitan* and *Clatrotitan* synonymous, but Riek (1954) considered *Mesotitan* to be a separate genus (Jell, 2004). Jell (2004) concluded that an argument could be made to support the contention of Riek (1954), but there seems good reason to classify them within the one family Titanoptera.

Subphylum Crustacea Brünnich, 1772

Robin Tillyard (Tillyard and Dunstan, 1916) noted that, amongst the insect specimens forward to him by Benjamin Dunstan, Chief Government Geologist of Queensland, there were several isopod specimens. Tillyard initially forwarded some of these for taxonomic identification to Charles Chilton, Professor of Biology, Canterbury College, New Zealand (Chilton, 1917). Chilton (1917) described and named these ten specimens, as well as a further four specimens forwarded later by Tillyard. All specimens were of the same species. Wilson and Edgecombe (2003) compared this species with extant taxa, carrying out a cladistical analysis in relation to other extinct and extant species.

Class Malacostraca Latreille, 1802

Order Isopoda Latreille, 1817

Suborder Phreatoicidea Stebbing, 1893

Family Amphisopodidae Nicholls, 1943

Protamphisopus wianamattensis (Chilton, 1917)

Figs 6h–j

Phreatoicus wianamattensis Chilton, 1917: 365-388.
Protamphisopus wianamattensis—Nicholls, 1943: 111, fig. 26.
Protamphisopus wianamattensis—Wilson and Edgecombe, 2003: 455–459.

Type: AM F.16970—held in the AMTC under "Chilton 1917".

Mentioned: AM F.49331 (Fig. 6h), AM F.49322 (Fig. 6i), AM F. 49323, AM F.49334—held in the AMTC under "Chilton 1917".

Other specimens: Seven blocks from the Dunstan collection held in the NHMUK collection.

Following a preliminary naming of this isopod species by Tillyard and Dunstan (1916), Chilton (1917) officially adopted the name *Phreatoicus wianamattensis* in his description, placing the specimens within the Phreatoicidae. The total length of the animal was probably 30 mm (Chilton, 1917). Nicholls (1943) transferred this species to *Protamphisopus* within the Amphisopodidae.

Chilton (1917) stated that this species is similar to the living *P. australis* discovered in shallow waters on Mt. Kosciusko, Australia. He also posited an interesting affinity to some extant *Phreatoicus* species which live with *Anaspides,* a peculiar freshwater shrimp in Tasmania's high-altitude lakes. At that time he commented that, as yet, no fossils had been found of *Anaspides'* group, the Syncarida. Eleven years later, Chilton (1929) described *Anaspides? antiquus*, a fossil found at Brookvale (Beacon Hill Quarry).

Wilson and Edgecombe (2003) commented that the earliest specimens of Phreatoicidea have been found in Carboniferous rocks and that these species have been found in both marine and estuarine facies. However, all extant Phreatoicidea occur in fresh waters, and therefore *P. wianamattensis* (Fig. 6j) represents the earliest known species to have inhabited fresh water (Wilson and Edgecombe, 2003). They carried out a cladistical analysis including all known genera and concluded that *P. wianamattensis* is a member of the crown group of the phreatoicidean clade still living in Australian freshwaters.

Phylum Mollusca Linnaeus, 1758

Class Bivalvia Linnaeus, 1758

Order Venerida Gray, 1854

Family Glauconomidae Gray, 1854

Protovirgus sp.

Fig. 6k

Tillyard and Dunstan (1916), in noting the numerous fossil discoveries from the St Peters brickpits, reported many specimens of *Unio* and *Unionella*, referencing Etheridge (1888). However, although Etheridge (1888) described these genera, he was studying specimens from Goodlet and Smith's quarries in the Wianamatta Group shales, nearby to the St Peters brickpits. No molluscs from the St Peters Brickpits have been described, but two specimens in the AMGC are labelled "St Peters". Although these specimens were initially identified as *Unio dunstani* and *Unio wianamattae,* their genus was emended to *Protovirgis* by Hocknull (2000).

The two specimens are:

AM F.29745 (Fig. 6k)—*Protovirgus dunstani*—held in the AMGC under "Bivalvia/Unionoida/Protovirgis".

AM F.29747—*Protovirgus wianamattae*—held in the AMGC under "Bivalvia/Unionoida/Protovirgus".

Kingdom Plantae Copeland, 1956

Several plant specimens were recovered from the St Peters brickpits. Most were only preliminarily identified, but two were described in some detail by Ratte (1887, 1888).

Order Ginkgoales Gorozhankin, 1904

Family Ginkgoaceae Engler, 1897

Salisburia palmata (Ratte, 1887)

Fig. 7a

Jeanpaulia? palmata Ratte, 1887: 1078–1081, pl. 17.
Salisburia palmata—Ratte, 1888: 137, 138.

Type: AM F.1557 (Fig. 7a)—complete leaf and petiole—held in the large specimen section of the AM collection.

Ratte (1887: 1078) commented that this specimen is "the most beautiful specimen of the most singular genus of fossil plants ever found in Australia". He initially described it as having an outline of a palmate leaf like *Jeanpaulia bidens,* then classed as a fern. He named it a new species, *J. palmata*, but with some doubt about the generic identification. After further investigation of northern hemisphere publications, Ratte (1888) reassigned it to *Salisburia palmata*.

Order Cycadales Dumortier, 1829

Family *insertae sedis*

Cycadopteris? scolopendrina Ratte, 1887

Fig. 7c

Type: AM F.1549 (Fig. 7c)—incomplete frond—held in the AMTC under "Ratte 1887b".

Ratte (1887) noted that this single specimen resembled both *Cycadopteris* and *Lomatopteris* from the northern hemisphere. He chose *Cycadopteris* after examining the borders of the frond.

Other Plantae specimens

The names listed below are the original identifications noted during registration.

AM F.1478—*Cycadopteris scolopendrina*. AM F.1540 (Fig. 7b)—*Dicroidium odontopteroides* (2 specimens). AM F. 14960—*Dicroidium odontopteroides*. AM F.4489—*Ginkgo digitata*. AM F.4490—*Taeniopteris crassinervis*. AM F.29774 (Fig. 7d)—*Cladophlebis australis*—all held in the AMGC.

Bowral Brick Quarry

Bowral Brickworks was opened in 1920, and is still in operation in 2025. After the early fossil discoveries, no other scientific collections had been made from this site until 2024. Recent inspections have identified several large fish specimens, as well as temnospondyls.

Fish

Class Actinopterygii *sensu* Goodrich, 1930

Sub-class Neopterygii Regan, 1923

Order Semionotiformes Aramberg & Bertin, 1958

Family Semionotidae Woodward, 1890

Corunegenys bowralensis Wade, 1941b

Fig. 8a

Holotype: AM F.18864 (Fig. 8a)—nearly complete, unique specimen—held in the AMTC under "Wade 1941c".

Specimens of fishes discovered at Brookvale (Beacon Hill Quarry) and St Peters brickpits had previously been identified as Semionotidae, but Wade (1941a) re-assigned them all to a new family Promecosominidae as several morphological characters did not match the semionotids. However, in the same paper he noted that at Bowral a nearly normal member of Semionotidae had been found that he would describe in a later paper (Wade, 1941b).

Wade (1941b) then later described the Bowral specimen. He erected *Corunegenys,* named from the Greek meaning "club jaw", to contain this new species. At that time, Semionotidae were placed in the Order Holostei. The holotype was 66 mm from snout to tail base. Although several fish fossils have been obtained from the Bowral Brick Quarry, only this specimen has been described taxonomically.

Other specimens

Fishes

The following specimens are held in the AMGC under "Pisces/Triassic/Bowral Brick Quarry".

***Cleithrolepis* sp**. Four specimens (including parts and counterparts)—including AM F.56305 (Fig. 8b)—collected in 1968 and presented by A. Howie in 1973.

Figure 7. Fossils from St Peters brickpits. Plantae. (*a*) AM F.1557. *Salisberia palmata*. (*b*) AM F.1540. *Dicroidium odontopteroides*. (*c*) *Cycadopteris(?) scolopendrina*. (d) AM F.29774. *Cladophlebis australis*. Scale bars = all 20 mm.

Figure 8. *a–f* Fossils from Bowral Brick Quarry. Temnospondyli. Fishes. Mollusca. Plantae. *g–i* Fossils from Gibraltar Tunnel. Temnospondyli. Fishes. (*a*) AM F.18864. *Corunegenys bowralensis*. (*b*) AM F.56305. *Cleithrolepis granulatus.* (*c*) AM F.54102. Xenacanthid fragment. (*d*) AM F.39304. indet. fish. (*e*) AM F.144841. *Protovirgus* sp.? (*f*) AM F.51295 *Cylostrobus sydneyensis*. (*g*) AM F.137629. ?Xenacanthid fragment. (*h*) AM F.137628. Temnospondyl fragment. (*i*) AM F.147920. *Palaeoniscus antipodeus*. Scale bars: *a,b,d,i* = 20 mm, *c* = 50 mm, *e,f* = 10 mm.

Xenacanthid. Four fragmentary specimens—AM F.54100, AM F.54101, AM F.54102 (Fig. 8c), AM F.54103—collected and presented by A. Howie in 1969. These specimens possibly include hybodontid remains (S. Turner pers. comm., 2008).

Pleurocanth? Two fin spines—AM F.54104 (missing)—collected and presented by A. Howie in 1969. They are possibly not a pleurocanth, perhaps a sphenocanth or hybodont (S. Turner pers. comm., 2008).

Unidentified fishes. Two specimens—including AM F.39304 (Fig. 8d)—presented by F. Watson in 1940.

Phylum Mollusca Linnaeus, 1758

The following specimen is held in the AMGC under "Mollusca/Unionidae/Protovirgis".

***Protovirgis* sp?** AM F.144841 (Fig. 8e).

Kingdom Plantae Copeland, 1956

The following specimens are held in the AMGC under 'Plantae/Triassic/Bowral Brick Quarry".

Cylostrobus sydneyensis—(AM F.51295) (Fig. 8f)—collected by H.O. Fletcher (AM) in 1964.

Unidentified plant—(AM F.47919)—presented by H. Roper executors in 1970.

Campbelltown (Chapel Hill)

Fish

In the early 1860s the Rev. W.B. Clarke of Sydney forwarded two fossil fish specimens and four fish photos to Sir Philip de Malpas Grey Egerton in England for identification. From these specimens and photos Egerton named two new genera and three new species. The specimens were from three sites, Cockatoo Island, Chapel Hill near Campbelltown, and Parsonage Hill near Parramatta (Egerton, 1864). Egerton (1864) matched the specimen from Campbelltown (Chapel Hill) with one of the photos from Cockatoo Island, identifying both to be *Myriolepis* species. He named these *M. clarkei*. The specimen whose photograph was forwarded to Egerton is held in the AMTC.

Class Actinopterygii *sensu* Goodrich, 1930

Order Palaeonisciformes Hay, 1902

Family Palaeoniscidae Bonaparte,1846

Myriolepis clarkei Egerton, 1864

Type: Ironstone fragment containing middle portion of fish—from site at Chapel Hill near Campbelltown—not figured in Egerton 1864—not registered in the NHMUK collection—lost.

Figured in Egerton (1864): AM F.5729—head and anterior trunk section of fish—from Cockatoo Island (Biloela)—held in the AMTC under "Egerton 1864". (Photograph of AM F. 5729 is published in Egerton (1864: pl. 1 fig. 1).

It is unfortunate that the holotype specimen from Chapel Hill was not figured, as it has been subsequently lost. However, the actual figured specimen that was the subject of the photograph of the Cockatoo Island fossil reproduced in Egerton (1864: pl. 1 fig. 1) has been found and is available for study in the AMTC under "Egerton 1864".

Gibraltar Tunnel Railway Cutting (near Bowral)

After the construction of the Gibraltar Railway Tunnel for the southern railway near Bowral during the late 1860s to early 1870s, many specimens of freshwater bivalves were collected by Benjamin Dunstan from the adjacent cutting and forwarded to Robert Etheridge for classification. Some fish and plant specimens were also collected but were not specifically described from this site. The railway cutting was made through shale of the Wianamatta Group.

Class Amphibia Gray, 1825

Two fossil fragments were described by Stephens (1887; 1190) as temnospondyli. Although one specimen (AM F.137629) (Fig. 8g) now is most likely to be a xenacanthid, the other (AM F.137628) (Fig. 8h) appears to be a maxillary bone of a temnospondyl with the remains of five teeth. These specimens are held in the AMTC under "Stephens 1887c".

Fishes

No fish were described from this site, but some specimens were collected. They were:

Palaeoniscus antipodeus. AM F.147920 (SUP 990) (Fig. 8i)—held in the AMGC under "Pisces/Triassic/Gibraltar Tunnel".

?Semionotus. One specimen—held in the AMGC under "Pisces/Triassic/Gibraltar Tunnel".

Unidentified fish. One fragment—collected before 1895—held in the AMGC under "Pisces/Triassic/Gibraltar Tunnel".

Phylum Mollusca Linnaeus, 1758

Class Bivalvia Linnaeus, 1758

Order Venerida Gray, 1854

Family Glauconomidae Gray, 1854

Protovirgus dunstani (Etheridge, 1888)

Fig. 9a

?Unio dunstani Etheridge, 1888: 11, pl. 1 figs 11–19.
Protovirgis dunstani—McMichael, 1956: 232, pl. 14 fig. 8.

Lectotype: AM F.35776 (Fig. 9a) (pl. 1 figs 13–14)—selected by McMichael (1956)—articulated bivalve—held in the AMTC under "Etheridge 1888".

Paralectotypes: AM F.35779 (pl. 1 figs 11–12), AM F.35780 (pl. 1 figs 15–16), AM F.35777 (pl. 1 figs 17–18)—articulated bivalves—all held in the AMTC under "Etheridge 1888". AM F.35765 (pl. 1 fig. 19)—articulated bivalve—missing.

Other specimens: AM F.3173, AM F.1545—both held in the AMGC under "Bivalvia/Unionoida". L71270, L71271—*Unio* sp.—could be associated species—held in the NHMUK collection. L71288–71292—*Unio* sp.—individuals in tube—could be associated species—held in NHMUK collection.

The shells are narrow and transversely elongated, approaching a linguliform shape. This species was plentiful in the formation uncovered by the cutting excavation (Etheridge, 1888). Etheridge detected several characters

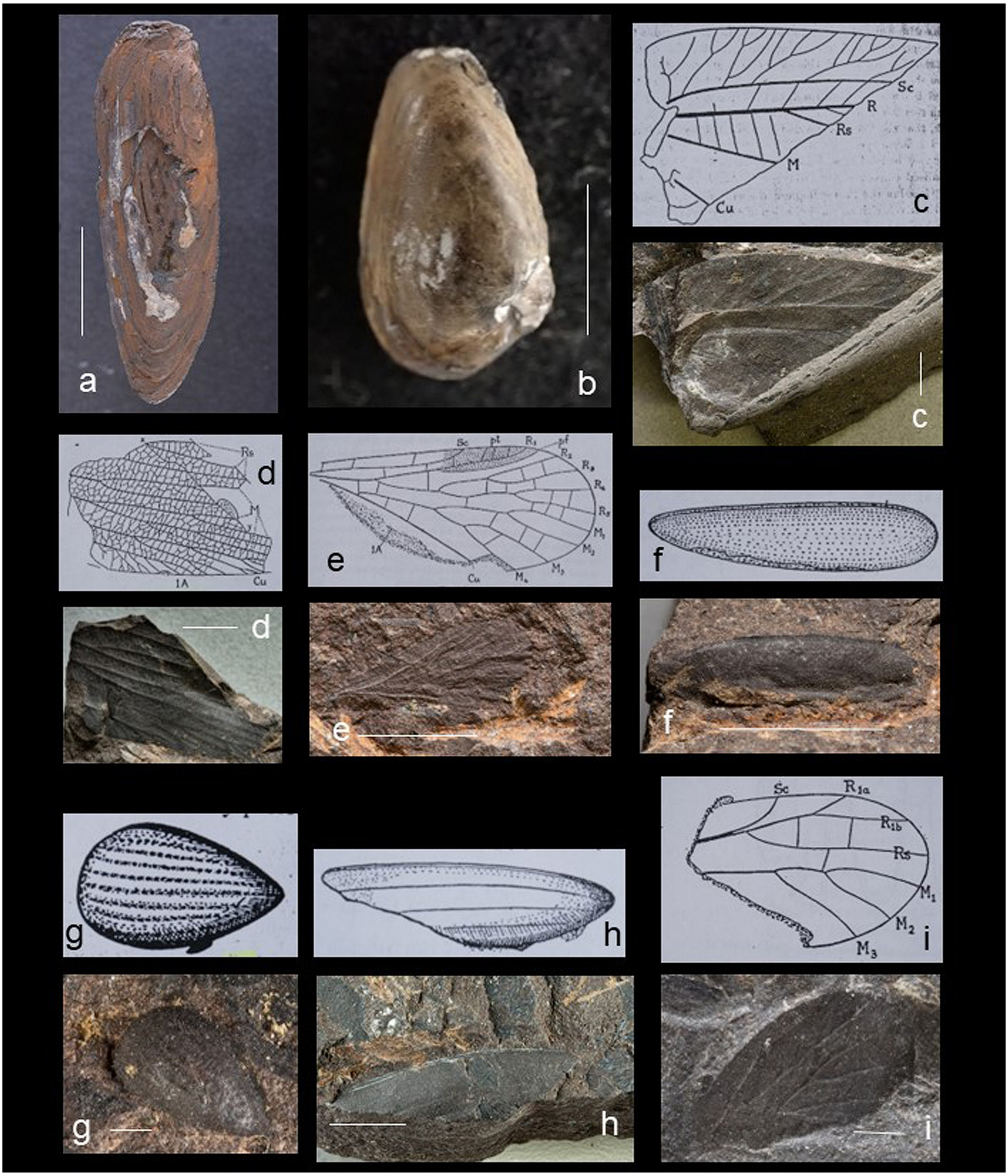

Figure 9. *a,b* Fossils from Gibraltar Tunnel. Mollusca. *c–i* Fossils from Glenlee Cutting. Insecta. (*a*) AM F.35776. *Protovirgus dunstani*. (*b*) AM F.35767. *Unionella wianamattensis*. (*c*) AM F.39324. *Notoblattites wianamattensis*. (*d*) AM F.28467. *Notoblattites mitchelli*. (*e*) AM F.39326. *Mesopanorpodes wianamattensis*. (*f*) AM F.39328. *Elateridium angustius*. (*g*) AM F.39329. *Adelidium cordatum*. (*h*) AM F.39330. *Metrorhynchites grandis*. (*i*) AM F.39331. *Triassopsylla plecioides*. *c–i* artwork reproduced from Tillyard (1918) © Linnean Society of NSW. Scale bars: *a–c* = 10 mm, *d–f,h* = 5 mm, *g,i* = 1 mm.

of the genus *Unio* in these specimens but admitted that some others were missing, so he made only a provisional identification (Etheridge, 1888). At this time *Unio* was placed in Unionidae (Unionacea; Pelecypoda).

McMichael (1956), while examining the specimens described by Etheridge (1888), noted that this species differed from all other freshwater bivalves from Australia, and was like an undescribed Cretaceous species from New Zealand. He erected *Protovirgus*, to include both these species. As Etheridge had failed to select a type (presumedly meaning all figured specimens were syntypes) McMichael (1956) selected a lectotype and treated all other figured specimens as paralectotypes. Hocknull (2000) moved this species to Glauconomidae as it had several characteristics allied to this modern family.

Unionella wianamattensis (Etheridge, 1888)

Fig.9b

Unionella bowralensis Etheridge, 1888: 13, pl. 1 figs 21–23, pl.2 figs 8–14.—synonymised by Hocknull (2000).
Unionella carnei Etheridge, 1888: 14, pl. 1 fig. 20, pl. 2 figs 5–7.—synonymised by Hocknull (2000).
?Unio wianamattensis Etheridge, 1888: 10, pl. 2 figs 1–4.—from Waterloo Brick-clay Quarry—synonymised by McMichael (1956)
Unionella wianamattensis—McMichael, 1956. 235, pl. 14 figs 4–5.
Unionella wianamattensis—Hocknull, 2000: 420, fig. 6K.

Lectotype: AM F.35775—from Waterloo Brick-clay Quarry—held in AMTC under "Etheridge 1888a".

Paralectotypes: AM F.35773—from Waterloo Brick-clay Quarry—held in the AMTC under "Etheridge 1888a".
AM F.35767 (Fig. 9b)—from Gibraltar Tunnel—held as *Unionella bowralensis* in the AMTC under "Etheridge 1888a".

Figured: In Etheridge (1888) as *Unionella bowralensis*:
AM F.35763 (pl. 1, fig. 21)—articulated bivalve. AM F.35768 (pl. 1, fig. 22)—articulated bivalve. AM F.35693 (MMF 3118) (pl. 1, fig. 23)—conglomerate mass of bivalves. AM F.35775 (pl. 2, figs 1–2)—articulated bivalve. AM F.35773 (pl. 2, fig. 4)—crushed specimen. AM F.35769 (pl. 2, fig. 8)—internal cast. AM F.35774 (pl. 2, fig. 9)—articulated bivalve. AM F.35772 (pl. 2, fig. 10)—articulated bivalve. AM F.35771 (pl. 2, fig. 11)—articulated bivalve. AM F.35770 (pl. 2, fig. 12)—internal cast. AM F.35767 (pl. 2, figs 13–14)—articulated bivalve. All specimens held in the AMTC under "Etheridge 1888".

Figured: In Etheridge (1888) as *Unionella carnei*:
AM F.35766 (pl. 1, fig. 20)—imperfect bivalve. AM F.35778 (pl. 2, figs 5–6)—articulated bivalve. AM F.35764 (pl. 2, fig. 7)—articulated bivalve. All specimens held in the AMTC under "Etheridge 1888".

Other specimens: AM F.1544—held in the AMGC under "Bivalvia/Unionoida". AM F.3178—held in the AMGC under "Bivalvia/Unionoida".

Etheridge (1888) erected *Unionella* to contain the small bivalves found in the Gibraltar Tunnel railway cutting. Muscle impressions separate the genus from *Unio* (Etheridge, 1888). Within *Unionella* Etheridge (1888) erected two species from the Gibraltar Tunnel material, *Unionella bowralensis* and *Unionella carnei*. *Unionella carnei* is distinguished by a quadrangular outline and an erect and straight hinge line. At this time *Unionella* was placed in Unionidae (Unionacea; Pelecypoda).

McMichael (1956) re-examined Etheridge's (1888) two species and suggested they may be synonymous, along with *Unio? wianamattensis* Etheridge, 1888. As part of the discussion he suggested these taxa could be polymorphs or perhaps ecophenotypes of the same species. However, he refrained from synonymising them and left all three separate within *Unionella*. As Etheridge had failed to select a holotype McMichael (1956) selected a lectotype, a paralectotype and a syntype.

Hocknull (2000) transferred these three species to Glauconomidae as they shared characteristics with the family. He also synonomised them, arguing there was not enough variation to warrant separation. He argued the differences could be potentially due to phenotypic plasticity. Therefore *Unionella wianamattensis* took priority and was retained.

Kingdom Plantae Copeland, 1956

No plants have been described from this site, but several specimens were collected and are held in the AMGC under "Plantae/Triassic/Gibraltar Tunnel". These are:

***Phyllotheca* sp**. Two specimens purchased in 1898.
***Podozomites* sp**. One specimen collected in 1891.
Dicroidium elongatum. One frond (part and counterpart) collected in 1891.
Cylostrobus sydneyensis. One specimen collected in 1964.

Glenlee Railway Cutting

During the construction of the southern railway line from Sydney in the 1870s, fossiliferous shales were encountered in a cutting near Glenlee Homestead, about seven kilometres south of Campbelltown. The cutting was made through the shales of the Wianamatta Group.

Class Insecta Linnaeus, 1758

Tillyard (1918a) described a group of insect specimens from the collection of John Mitchell, the former Principal of Newcastle Technical College. Amongst this collection were 16 specimens from the Glenlee Railway Cutting. They formed a similar assemblage to the St. Peters specimens (Jell, 2004).

Order Blattodea Brunner von Wattenwyl, 1882

Family *incertae sedis*

Notoblattites wianamattensis Tillyard, 1918a

Fig. 9c

Type: AM F.39324 (Fig. 9c)—section of wing—Mitchell Collection No.3—collected 18/9/1892—held in the AMTC under "Tillyard 1918a".

The genotype of this cockroach species, *Notoblattites subcostalis* from the Wianamatta shales of the St Peters brickpits was described by Tillyard and Dunstan (1916) and placed in Blattoidea. The Glenlee Cutting specimen is a basal wing fragment in dark greyish shale. Tillyard (1918a), in describing this species, removed the assignment of the genus from Blattoidea to Protorthoptera after re-examining the tegmen resting position. Jell (2004) synonomised this genus with Blattaria, now synonymised with Blattodea.

Notoblattites mitchelli Tillyard, 1918a

Fig. 9d

Type: AM F.28467 (Fig. 9d)/AM F.39325—fragment of wing (part and counterpart)—Mitchell Collection Nos 1,2—held in the AMTC under "Tillyard 1918a".

There is a close resemblance between this specimen and the genotype *Notoblattites subcostalis*. However, slight variation in venation of the wings warranted identification of this material as a new species (Tillyard, 1918a).

Order Mecoptera Packard, 1886

Family Mesopsychidae Tillyard, 1917

Mesopanorpodes wianamattensis (Tillyard, 1918a)

Fig. 9e

Mesopanorpa wianamattensis Tillyard, 1918a: 747, text fig. 10.
Mesopanorpodes wianamattensis—Tillyard, 1918b: 435.

Type: AM F.39326 (Fig. 9e)—almost complete wing—Mitchell Collection No.5—held in the AMTC under "Tillyard 1918a".

Tillyard (1918a) erected Mesopanorpidae to contain this taxon, while noting a close resemblance to the recent scorpion fly *Panorpodes*. Later, Tillyard (1918b) changed the genus to *Mesopanorpodes* to avoid a homonymy. Subsequently many authors referred to Mesopanorpodidae in their discussions. Bashkuev (2011) revised the Mesopanorpodidae and provisionally transferred *Mesopanorpodes* to Mesopsychidae to await further analysis and comparison with the closely related *Mesopsyche*.

Order Coleoptera Linnaeus, 1758

Family Elateridae Leach, 1815

Elateridium angustius Tillyard, 1918a

Fig. 9f

Type: AM F.39328 (Fig. 9f)—almost complete elytron—Mitchell Collection No. 14—held in the AMTC under "Tillyard 1918a".

This specimen is a long, narrow elytron closely resembling the genotype *Elateridium wianamattensis* from the St Peters brickpits described by Tillyard and Dunstan in 1916 (Tillyard, 1918a).

Family Tenebrionidae Latreille, 1802

Adelidium cordatum Tillyard, 1918a

Fig. 9g

Type: AM F.39329 (Fig. 9g)—complete elytron—Mitchell Collection No. 17—held in the AMTC under "Tillyard 1918a".

The specimen is a well-preserved elytron, 4 mm long, well rounded towards the base and strongly pointed at the apex (Tillyard, 1918a).

Family Schizocoleidae Rohdendorf, 1961

Metrorhynchites grandis Tillyard, 1918a

Fig. 9h

Type: AM F.39330 (Fig. 9h)—a cast of a greater portion of a left elytron—Mitchell Collection No. 20—held in the AMTC under "Tillyard 1918a".

The specimen is part of a large, elongated, convex elytron. There is some doubt that this specimen is referable to *Metrorhynchites*, as it differs in size and shape, as well as the pattern of striae which do not unite near the apex (Tillyard, 1918a). Tillyard and Dunstan (1916) and Tillyard (1918a) placed this genus in the Malacodermidae. Later, it was transferred to Schizocoleidae.

Other Coleoptera specimens

Several unidentified insect specimens of Coleoptera from the Mitchell Collection are held in the AMTC under "Tillyard 1918a". These are:

AM F.39332—Mitchell Collection No.9—a fragment of large elytron 11 mm long.
AM F.39333—Mitchell Collection No.12—a nearly complete elytron 12.5 mm long.
AM F.39334—Mitchell Collection No.16—a small, convex elytron 2.7 mm long.
AM F.39335—Mitchell Collection No.34—a nearly complete, elongated elytron, 10.mm long.
AM F.39336—Mitchell Collection No.36—a portion of a mould of a large elytron, 8.8 mm long.

Order Hemiptera Linnaeus, 1758

Family Psyllidae Latreille, 1807

Triassopsylla plecioides Tillyard, 1918a

Fig. 9i

Type: AM F.39331 (Fig. 9i)—a portion of a wing—Mitchell Collection No. 4—held in the AMTC under 'Tillyard 1918a".

This true bug is approximately 4.6 cm long with the basal half missing (Tillyard, 1918a). Tillyard (1918a) placed this specimen in the Suborder Homoptera.

Other Hemiptera specimens

Several unidentified insect specimens of Hemiptera from the Mitchell Collection are held in the AMTC under "Tillyard 1918a". These are:

AM F.39337—Mitchell Collection No.7—fragments of tegmina.
AM F.39338—Mitchell Collection No.8—fragments of tegmina.
AM F.39339—Mitchell Collection No.11—fragments of tegmina.
AM F.39340—Mitchell Collection No.13—fragments of tegmina.

Subphylum Crustacea Brünnich, 1772

During 1890 John Mitchell, Principal of the Technical College and School of Mines, Newcastle NSW, collected some *Estheria* specimens from the Glenlee Railway Cutting, but did not describe them until 1927.

Class Branchiopoda Latreille, 1817

Subclass Phyllopida Preuss,1951

Order Diplostraca Gerstaecker, 1866

Suborder Spinicaudata Linder, 1945

Family Limnadiidae Burmeister, 1843

Palaeolimnadia coghlani (Cox,1881)

Fig.10a

Estheria coghlani Cox, 1881: 276—Etheridge, 1888: 6, pl.1 figs 1–5.
Estheria coghlani.—Mitchell, 1927: 106, pl. 2 figs 3–5.
Palaeolimnadia coghlani.—Raymond, 1946: 264.

Type: Obtained from Moore Park Borehole by Cox (1881) but subsequently lost—sketches described by Etheridge (1888).
Figured: AM F.25474 (pl. 2 fig. 5)—single valve, AM F.25483 (Fig. 10a) (pl. 2 fig. 4)—single valve, AM F.25492 (pl. 2 fig. 3)—single valve—all held in the AMTC under "Mitchell 1927".

Specimens of this species from Sydney Basin boreholes were named by Cox (1881) and then described by Etheridge (1888), who placed the species within Crustacea and Phyllopida. The higher taxa structure for Crustacea was subsequently modified.

Mitchell (1927) stated that he had in his possession a specimen from Glenlee of this species first found in the Estheria Shales at several Sydney boreholes. As the borehole specimens were found in the lower levels of the Narrabeen Group, just above the Permian coal measures, and his specimen came from the Wianamatta Group at Glenlee, Mitchell commented on the persistence of this species throughout the Early and Middle Triassic. Raymond (1946) recognised these specimens, as well as the other two taxa mentioned below, as belonging to the palaeolimnadiids after studying the umbo configuration and transferred them to *Palaeolimnadia.*

Palaeolimnadia glenleensis (Mitchell, 1927)

Fig.10b

Estheria glenleensis Mitchell, 1927: 108, pl. 2 fig. 6.
Palaeolimnadia glenleensis—Raymond, 1946: 265.

Type: AM F.25482 (Fig. 10b) (pl. 2 fig. 6)—held in the AMTC under "Mitchell 1927".
Co-type: AM F.25478—held in the AMTC under "Mitchell 1927"—not figured.
Other specimens: AM F.25491, AM F.25476—held in the AMTC under "Mitchell 1927"—not figured.

The carapace of this species is transversely oval, being 4 mm long and 3 mm wide approximately (Mitchell, 1927). Plants discovered with this specimen indicated a freshwater environment (Mitchell, 1927).

Palaeolimnadia wianamattensis (Mitchell, 1927)

Fig.10c

Estheria wianamattensis Mitchell, 1927: 108, pl. 2 figs 7–8.
Palaeolimnadia wianamattensis—Raymond, 1946: 263.

Type: AM F.25487 (Fig. 10c) (pl. 2 fig. 7)—held in the AMTC under "Mitchell 1927".
Lectotype: AM F.25490 (pl. 2 fig. 8)—held in the AMTC under "Mitchell 1927".
Co-type: AM F.25480—held in the AMTC under "Mitchell 1927"—not figured.

The carapace of this species is small convex, transversely elliptic, with length of 3 mm and width of 2 mm. It may represent an immature specimen (Mitchell, 1927).

Kingdom Plantae Copeland, 1956

Many plant specimens were recovered from the Glenlee Railway Cutting but none were specifically described, although some were identified. The AMGC holds plant fragment specimens bought from Mrs. S. Mitchell in 1930. These include: Ginkgo, *Cladophebis*, Equisetalians, *Sphenopteris,* AM F.56849 *Reinitzia* (Fig. 10d), *Phyllotheca* and *Skilliostrobus*.

Tillyard (1918a: 756) noted that some plant remains were present in his collection from Glenlee Railway Cutting, and these were registered with the AM. These are held in the AMTC under "Tillyard 1918".

Maldon Quarry

Class Malacostraca Latreille, 1802

Order Isopoda Latreille, 1817

Suborder Phreatoicidea Stebbing, 1893

Family Amphisopodidae Nicholls, 1943

Protamphisopus wianamattensis (Chilton, 1917)

Fig.10e

Phreatoicus wianamattensis Chilton, 1917: 365-388.
Protamphisopus wianamattensis—Wilson and Edgecombe, 2003: 304, fig.3.

Holotype: AM F.16970—from St Peters brickpits—held in the AMTC under "Chilton 1917".
Figured: AM F.129871 (Fig. 10e)—held in the AMTC under "Wilson 2008".

The isopod specimen (AM F.129871) from Maldon Quarry was used by Wilson to provide an age for particular nodes in his cladogram relating the evolution of blind versus sighted species of the Phreatoicidea. The Maldon specimen is thought to be Middle Triassic (238 Ma) in age, based on previous discovery of the species in the St Peters brickpits, and the species clearly possesses sight as its eyes are visible (Wilson, 2008).

Mortdale (Hurstville Brick Co. Quarry)

Class Amphibia Gray,1825

A skull roof impression from the Hurstville Brick Company site at Mortdale was found in the collection of the Geological Survey of NSW by John Pickett in 1965, and subsequently described by J.W. Cosgriff.

Order Temnospondyli Zittel, 1888 (in Zittel, 1887–1890)

Superfamily Brachyopoidea Lydekker, 1885

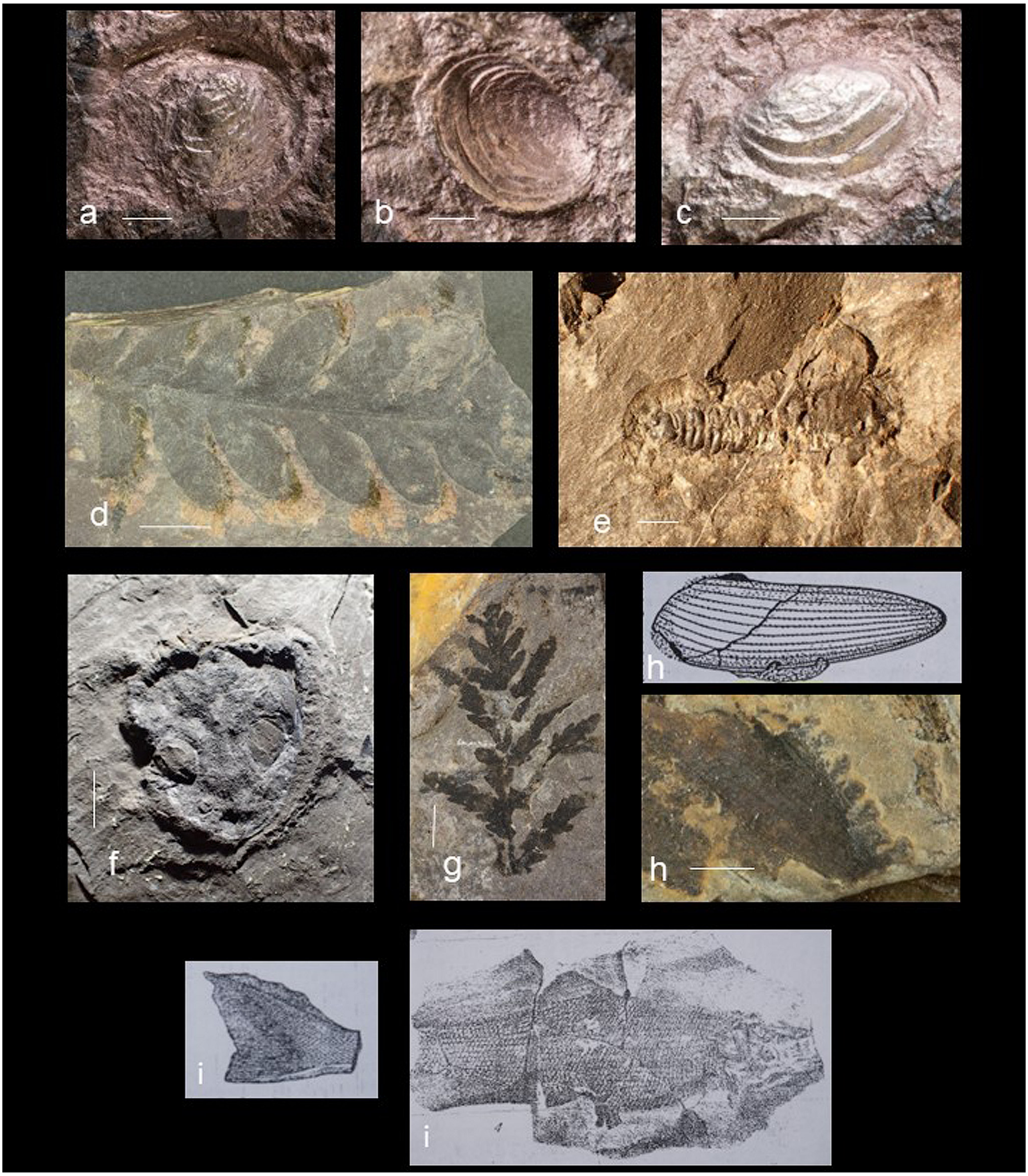

Figure 10. *a–d* Fossils from Glenlee Railway Cutting. *e* Fossil from Maldon Quarry. *f,g* Fossils from Mortdale. *h* Fossil from Narellan Railway Cutting. *i* Fossil from Parramatta (Parsonage Hill). (*a*) AM F.25483. *Palaeolimnadia coghlani.* (*b*) AM F.25482. *Palaeolimnadia glenleensis*. (*c*) AM F.25487. *Palaeolimnadia wianamattensis*. (*d*) AM F.56849. *Reinitsia* sp. (*e*) AM F.129871. *Protamphisopus wianamattensis.* (*f*) MMF 8258. *Notobrachyops picketti*. (*g*) AM F.31973. *Dicroidium odontopteroides*. (*h*) AM F.39327. *Ademosyne wianamattensis*. (*i*) *Palaeoniscus antipodeus*. Body and tail. *h* artwork reproduced from Tillyard (1918) © Linnean Society of NSW. *i* artwork reproduced from Egerton (1864) © Geological Society of London. Scale bars: *a–c,e,h* = 1 mm, *d,f,g* = 10 mm.

Family Brachyopidae Lydekker,1885

Notobrachyops picketti Cosgriff, 1973

Fig. 10f

Holotype: MMF 8258 (Fig. 10f)—held in the GSNSW collection.

The specimen is preserved on a slab of fine dark shale from the Ashfield Shale Formation. It is an external impression of a skull roof and part of the right lower jaw ramus. Its closer relationship to other Australian genera than to genera from South Africa implies that a section of this widely dispersed family underwent separate evolutionary radiation on this continent (Cosgriff, 1973).

Kingdom Plantae Copeland, 1956

Several plant specimens from this site were collected but not published. They are held in the AMGC under "Plantae/ Triassic/Mortdale". These include:

Dicroidium lancifolium—transferred from the Mines Department in 1933.
Dicroidium odontopteroides AM F.31973 (Fig. 10g)—transferred from the Mines Department in 1933. Equisetalean stem—transferred from the Mines Department in 1933. Equisetalean stems—presented by Warner in 1944. Spenopterid—presented by Warner in 1944.
***Schizoneura* sp**—transferred from the Mines Department in 1933.

Narellan Railway Cutting

The Narellan railway cutting is about 8 kilometres from Campbelltown, along the now abandoned branch line to Camden, and is cut through the Ashfield Shale of the Wianamatta Group.

Class Insecta Linnaeus, 1758

Order Coleoptera Linnaeus, 1758

Family Ademosynidae Ponomarenko, 1968

Ademosyne wianamattensis Tillyard, 1918a

Fig. 10h

Type: AM F.39327 (Fig. 10h)—complete elytron 4.5 mm long—Mitchell Collection No.10—held in the AMTC under "Tillyard 1918a".

This specimen has an elongate oval shape and showed the original elytron in position. It is darkly coloured and iridescent (Tillyard, 1918a). Tillyard (1918a) placed this species in Hydrophilidae, but later discussion suggested other families. Jell (2004) nominated Ademosynidae as the current placement.

Parramatta (Parsonage Hill)

St Johns Parsonage, Parramatta, designed by Francis Greenway, stood on Parsonage Hill until 1909. Today the intersection of O'Connell St. and the Great Western Highway (the A44) occupies this site.

Fish

Egerton (1864) described three fishes from specimens and photographs forwarded to him in England by the Rev. W.B. Clarke of Sydney. Amongst this submission was a photograph of a fish fossil comprising four matched fragments and with the tail missing. Another photograph depicted a tail, which Egerton was advised was the missing tail from the first photo. Egerton described and named a new species from this photograph (Egerton,1864). The origin of the specimen was stated to be Parsonage Hill in Parramatta, geologically placed in the Wianamatta Group.

Class Actinopterygii *sensu* Goodrich, 1930

Order Palaeonisciformes Hay, 1902

Family Palaeoniscidae Bonaparte, 1846

Palaeoniscus antipodeus Egerton, 1864

Fig. 10i

Type: Fish without a tail (photograph) (Fig. 10i)—Actual specimen lost.

Egerton (1864) found that all the characters of the specimen in the photo matched those of *Palaeoniscus*, except for the position of the dorsal fin. The tail, depicted in a separate photograph, was truly heterocercal in accordance with this genus.

Picton area

There are several fossil sites in the Ashfield Shale Formation exposed by road and railway cuttings in the Picton-Maldon-Camden area. Sharks, amphibians, insects, crustaceans and plants have been found enclosed in sideritic lenses at these sites (Béthoux and Beattie, 2010).

Class Amphibia Gray, 1825

Order Temnospondyli Zittel, 1888 (in Zittel 1887–1890)

Superfamily Trematosauroidea Watson, 1919

Family Trematosauridae Watson, 1919

Microposaurus averyi Warren, 2012

Fig. 11a

Holotype: AM F.135895 (Fig. 11a)—held in the AMTC under "Warren 2012".

An amphibian specimen was found by Steven Avery in the Rouse Hill Member of the Ashfield Shale Formation, near Picton. The specimen is a partial skull and attached mandible with dentition in an ironstone concretion. The skull length would have been approximately 400 mm long, and the specimen would have been a mature animal (Warren, 2012).

Figure 11. *a,b* Fossils from Picton. *c* Fossil from Waterloo. *d* Fossil from Alexandria. *e* Fossil from Bankstown (Potts Hill). *f* Fossil from McDonaldtown. (*a*) AM F.135895. *Microposaurus averyi*. (*b*) AM F.132815. *Iverya averyi.* (*c*) AM F.35775. *Unionella wianamattensis*. (*d*) AM F.15027. *Pristisomus gracilis.* (*e*) AM F.17923. *Cladophlebis australis*. (*f*) AM F.17958. *Palaeoniscus crassus*. *b* artwork reproduced from Béthoux & Beatty (2010) © Geological Society of China. Scale bars: *a* = 50 mm, *b* = 10 mm, *c* = 5 mm, *d–f* = 20 mm.

Fish

Class Chondrichthyes Huxley, 1880

Subclass Elasmobranchii Bonaparte, 1838

Order Xenacanthiformes Berg, 1955

Family Xenacanthidae Frič, 1889

Several specimens of the shark Xenacanthidae have been collected in the Picton area and are presently awaiting description in the AMGC and the AM offsite Discovery Centre. They are:

AM F.136048—skull, pectorals, AM F. 109756—anterior of snout of AM F.136048, AM F.129486—fragments, AM F.134489–124496—fragments, AM F.136043—skull, some post cranial skeleton, AM F.136044—skull, some post cranial skeleton, AM F.136045—vertebrae and sections of dorsal fin, AM F.136046—tail, AM F.136047—skull, post cranial skeleton, AM F.137124—large, almost complete fish, AM F.137125—skull, AM F.137126—anterior of small fish.

Class Insecta Linnaeus, 1758

Superorder Odonatoptera Lameere,1900

Order Odonata Fabricius, 1793

Family Triadotypidae Grauvogel and Laurentiaux, 1952

Iverya averyi Béthoux and Beattie, 2010

Fig. 11b

Holotype: AM F.132815/AM F.132816 (Fig. 11b)—part and counterpart of a wing—held in the AMTC under "Béthoux and Beattie 2010".

An insect wing was found by Steven Avery near the southern railway line at Picton. This specimen is an almost complete wing contained within a large sideritic lens (Béthoux and Beattie, 2010). Triadotypidae are basal Odonatoptera about which little is known. Until the discovery of this specimen, triadotypomorphans had only been reported from the northern hemisphere (Béthoux and Beattie, 2010).

Kingdom Plantae Copeland, 1956

A small number of plants from sites near Camden are held in the AMGC. They are:

Dicroidium antevsiana—one specimen donated by J. Mitchell in 1958.
***Phyllotheca* sp**.—one specimen purchased from Mrs. S. Mitchell in 1930.

Waterloo (Goodlet and Smith's Brick-clay Quarry)

In 1883 C.S. Wilkinson forwarded some bivalve specimens to Robert Etheridge Senior at the British Museum. They had been obtained from the Waterloo and Surry Hills quarries of Goodlet and Smith by T.W. Edgeworth David of the University of Sydney. The quarries worked the Ashfield Shale Formation in the centre of Sydney. Etheridge named them *Unio? wianamattensis* (Etheridge, 1888).

Phylum Mollusca Linnaeus, 1758

Class Bivalvia Linnaeus, 1758

Order Venerida Gray, 1854

Family Glauconomidae Gray, 1854

Unionella wianamattensis (Etheridge, 1888)

Fig.11c

Unio? wianamattensis Etheridge, 1888: 10, pl. 2 figs 1–4.—synonymised by McMichael (1956).
Unionella bowralensis Etheridge, 1888: 13, pl. 1 figs 21–23, pl. 2 figs 8–14.—synonymised by Hocknull (2000).
Unionella carnei Etheridge, 1888: 14, pl. 1 fig. 20, pl. 2 figs 5–7.—synonymised by Hocknull (2000).
Unionella wianamattensis—McMichael, 1956: 235, pl. 14 figs 4–5.
Unionella wianamattensis—Hocknull, 2000: 420, fig. 6K.

Lectotype: AM F.35775 (Fig. 11c)—from Waterloo site—held in the AMTC under "Etheridge 1888a".
Paralectotype: AM F.35773—from Waterloo site—held in the AMTC under "Etheridge 1888a".
Additional material: AM F.35781—approximately 46 specimens—held in the AMTC under "Etheridge 1888a".
Other specimens: L7125–7168—many small individuals—held in the NHMUK collection.

Etheridge detected several characters of the genus *Unio* in these specimens but admitted that some others were missing, so he made only a provisional identification (Etheridge, 1888), placing them in Unionidae (Unionacea: Pelecypoda).

McMichael (1956) re-examined these specimens and compared them to the *Unionella* specimens from the Gibraltar Tunnel railway cutting described by Etheridge (1888). He observed that the three species *Unio? wianamattensis*, *Unionella bowralensis* and *Unionella carnei* are very similar and may be the same species. However, he stopped short of reclassifying all three as one species but placed *Unio? wianamattensis* in *Unionella*. As Etheridge had failed to select a holotype, McMichael (1956) selected a lectotype and a paralectotype.

Hocknull (2000) re-allocated these three species to *Glauconomidae* as they have several characters allied to this modern family. He also grouped them into one species, as he believed there was not enough consistent variation to separate them, and any differences could be due to phenotypic plasticity. He chose to synonymise all the other taxa under *Unionella wianamattensis* as it held priority.

Macquarie Fields

Trace fossil

In 1970 sewage tunnel excavation within the Ashfield Shales revealed fossilised tracks in the tunnel roof at Macquarie Fields. The trackway was a natural cast of prints made in underlying shale. The exposed section consisted of three full strides (Pepperell and Grigg, 1973).

Study of the pace angulation and the angle of the digits indicated the tracks were probably made by a large "labyrinthodont" (an older term for temnospondyl) that may have been wading through shallow water (Pepperell & Grigg, 1973).

Minor unpublished sites

There were several sites around the Sydney Basin where specimens were collected but have not been the subject of a peer-reviewed publications. Nevertheless, they provided valuable information of the overall ecology of the Sydney Basin. These specimens reside in the general collections of a few organisations, including the Australian Museum where the following specimens are held in the AMGC. (The taxonomic names shown are that of the original identifications).

Alexandria

Fish

Palaeoniscus antipodeus—AM F.441
Pristisomus gracilis—AM F.15027 (Fig. 11d).

Bankstown (Potts Hill Reservoir)

Kingdom Plantae Copeland, 1956

Cladophebis australis—AM F.17923 (Fig. 11e)—one specimen from the Bringelly Shale Formation.

Canterbury Sewage Works

Kingdom Plantae Copeland, 1956

Phyllotheca australis—AM F.18498.

Croydon

Phylum Mollusca Linnaeus, 1758

Unio sp.—AM F.3985.

Epping

Fishes

Unidentified fish—3 fragments—AM F.76721, AM F.135620, AM F.135621.

Erskineville (Bakewell Brickworks)

Kingdom Plantae Copeland, 1956

Cylomeia undulata—AM F.16178—held in the AMTC under "White 1981b".

Ingleburn

Kingdom Plantae Copeland, 1956

Phyllotheca stem casts—6 fragments—AM F.66595.

Kogarah (Blakes Quarry)

Fish

Cleithrolepis granulatus—2 specimens—AM F.29597, AM F.36662.

Macdonaldtown (Beulah Brickworks)

Fishes

Palaeoniscus crassus —AM F.17958 (Fig. 11f).
?*Myriolepis*—AM F.39296.
?*Promecosomina*—AM F.17956.
Dictyopyge—AM F.17952.
Pristisomus gracilis—AM F.14262

Mittagong

Fishes

Unidentified fishes—4 partial specimens—AM F.87973.

Oatley

Fish

Enigmatichthys attenuates—AM F.30068.

Regents Park

Kingdom Plantae Copeland, 1956

Lycopod cone scales—one specimen from Bringelly Shale Formation—AM F.63764.

Ryde

Kingdom Plantae Copeland, 1956

Cladophebis—two specimens (part and counterpart)—AM F.21662, AM F.21663.

ECOSYSTEMS

The Wianamatta Group was laid down during a single regression after the inundation of the Hawkesbury Sandstone plain (Herbert, 1980b). The Ashfield Shale was probably initially formed by freshwater lakes. However, later this may have transitioned to brackish, shallow water marine conditions. The Bringelly Shale was deposited in extensive swamplands and meandering estuarine and alluvial channels. Sporadic coastal marshes and swamps existed as the coastline progressed east (Herbert, 1980b). This environment supported a range of plants and animals that were revealed as fossils and are reviewed in 'Flora and Fauna' above. Although there has yet to be published detailed ecosystem studies or trophic webs linking this Sydney Basin plant and animal life, one way of constructing a preliminary view of the ecosystem is to use this body of fossil knowledge to illustrate elements of this ecosystem.

The flora included the swamp dwelling horsetails and lycopsid *Cylostrobus sydneyensis,* and understory plants (e.g. the ginkgoes and pteridosperms). Tree ferns and conifers would have dominated and formed the canopies. *Protovirgus dunstani* and *Unionella wianamattensis* were freshwater bottom dwelling bivalves. The crustacean clam shrimps *Palaeolimnadia coghlani*, *P. glenleensis* and *P. wianamattensis* were present. A freshwater crustacean isopod *Protamphisopus wianamattensis* has also been found. The range of insect fossils found included Blattodea (cockroaches), Mecoptera (scorpion flies), Coleoptera (beetles), Hemiptera (sapsucking psyllids), Odonata (dragonflies) and one specimen of the extinct Titanoptera. Vertebrates were represented by many species of fishes and top predator amphibians. Xenacanthid sharks, a lungfish *Archaeoceratodus avus* and 12 species of ray-finned fish were identified. A complete skeleton of a 2.25 m long amphibian temnospondyl *Paracyclotosaurus davidi* indicated the large size reached by the apex predators of the time, and a skull of the temnospondyl *Microposaurus averyi* showed that other large amphibian species were present.

Over the first 15 million years of Triassic sedimentation in the Sydney Basin there was a continuous evolution of species undisturbed by catastrophic events. However, no sedimentary deposits after the end of the Middle Triassic exist in the Sydney Basin now. There may have been further deposits, but if so, these have completely eroded away (Herbert, 1980a). The Late Triassic stretched for another 36 million years.

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