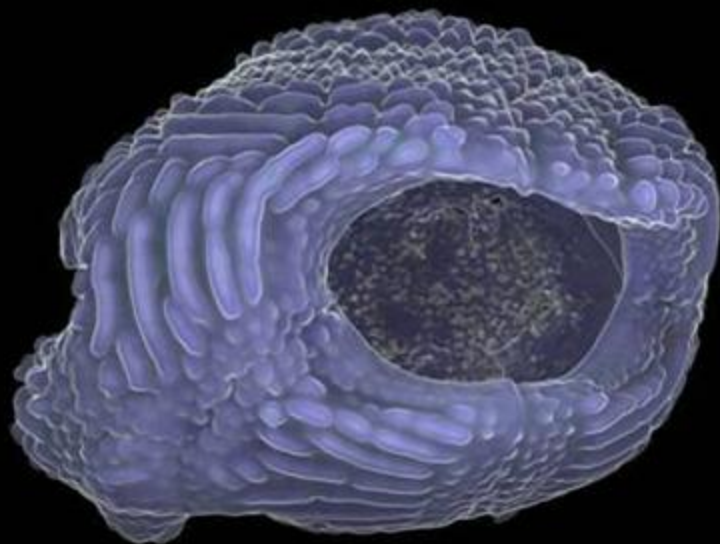


WEE JASPER-LAKE BURRINJUCK
FOSSIL FISH SITES
Nomination for National Heritage listing

GAVIN YOUNG

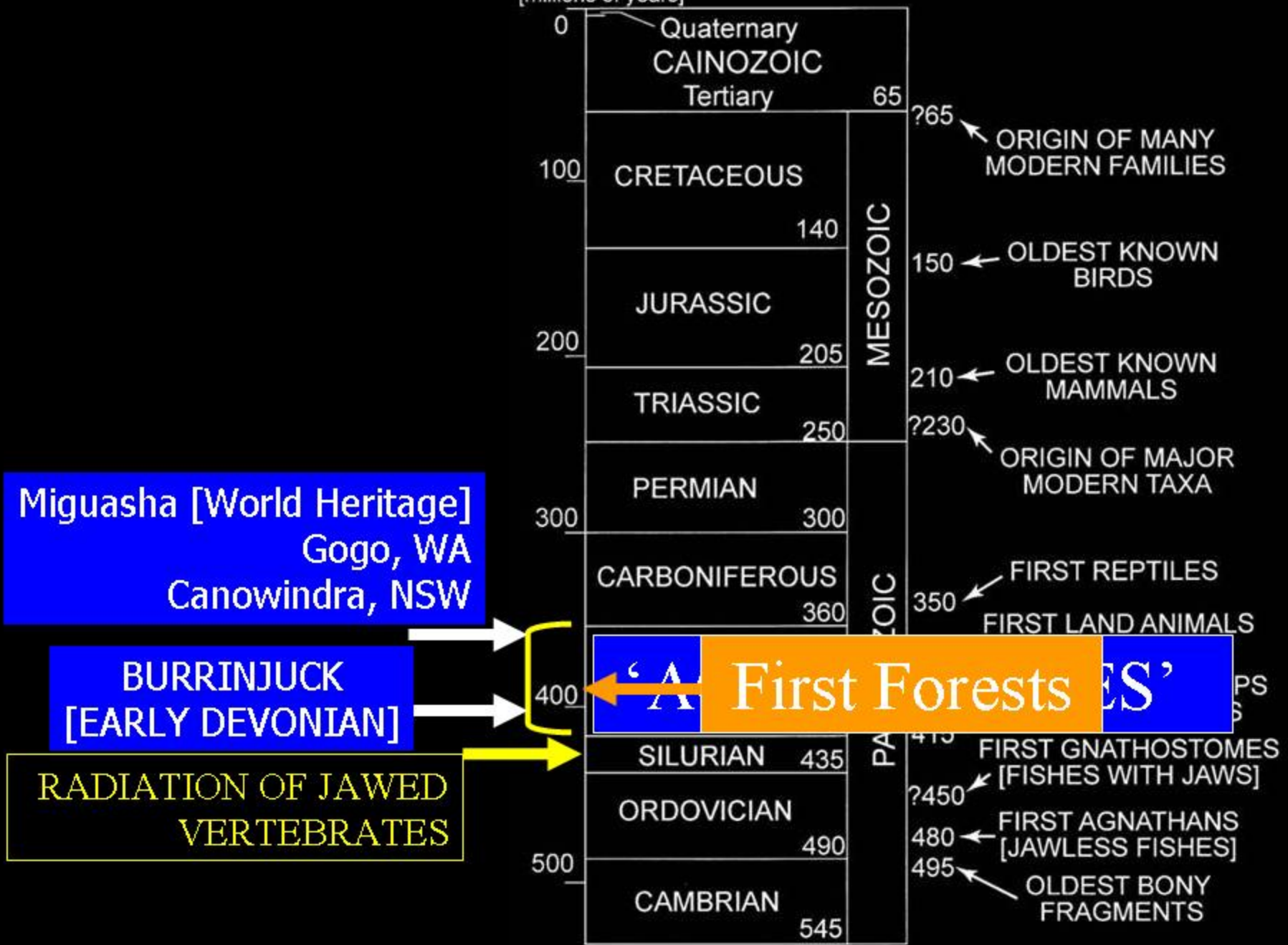
Research School of Earth Sciences

ANU



MAJOR EVENTS IN VERTEBRATE EVOLUTIONARY HISTORY

AGE
[millions of years]



Miguasha [World Heritage]
Gogo, WA
Canowindra, NSW

BURRINJUCK
[EARLY DEVONIAN]

RADIATION OF JAWED
VERTEBRATES

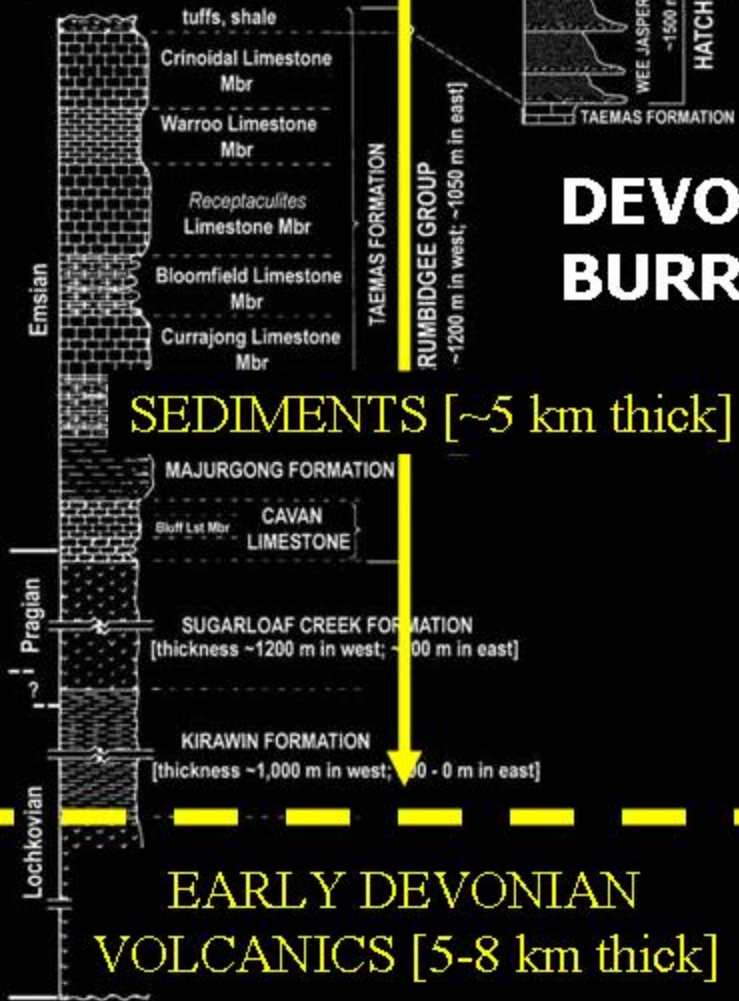
'A First Forests ES'

BASE OF M. DEV.

392 Ma



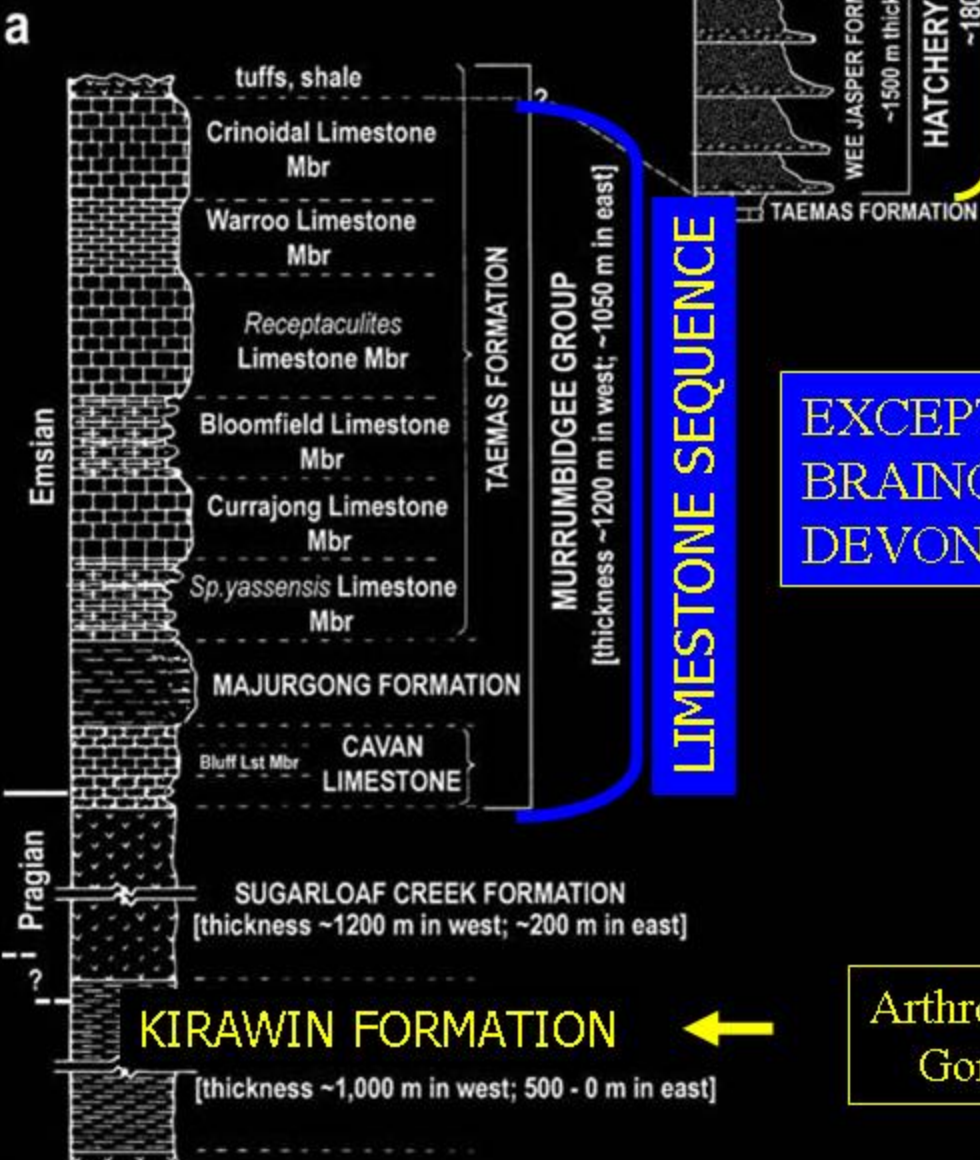
a



DEVONIAN SEQUENCE, BURRINJUCK AREA

DEVONIAN SEQUENCE, BURRINJUCK AREA

HATCHERY CREEK GROUP



Hatchery Ck Gp – 50 new fossil sites;
oldest root systems and leaves?

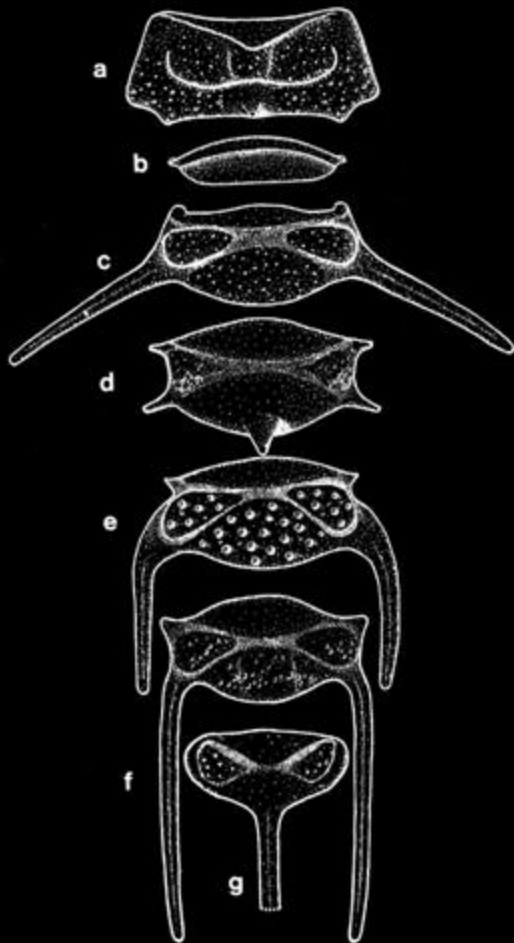
EXCEPTIONAL VERTEBRATE BONE &
BRAINCASE PRESERVATION IN EARLY
DEVONIAN REEFAL LIMESTONES

Arthropods (?myriapods) :
Gondwana's oldest land animals?

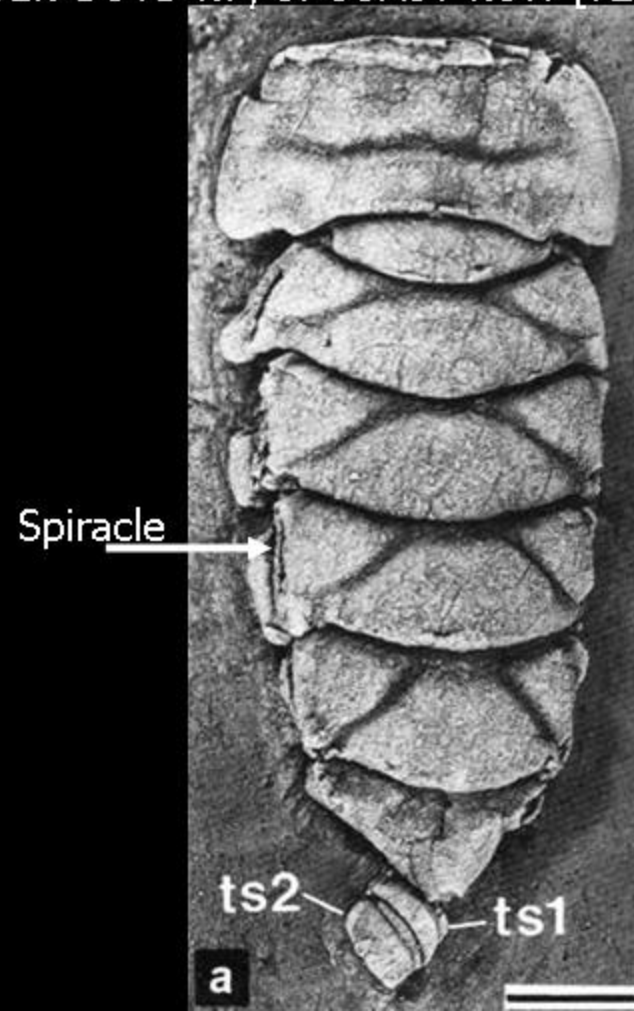
Myriapod *Maldybulakia* from the Early Devonian of Burrinjuck – GONDWANA'S OLDEST LAND ANIMAL?

Edgecombe, G.D. 1998a. *Nature* **394**: 172-74.

M. angusi
SUGARLOAF CK FM [E. DEV.]



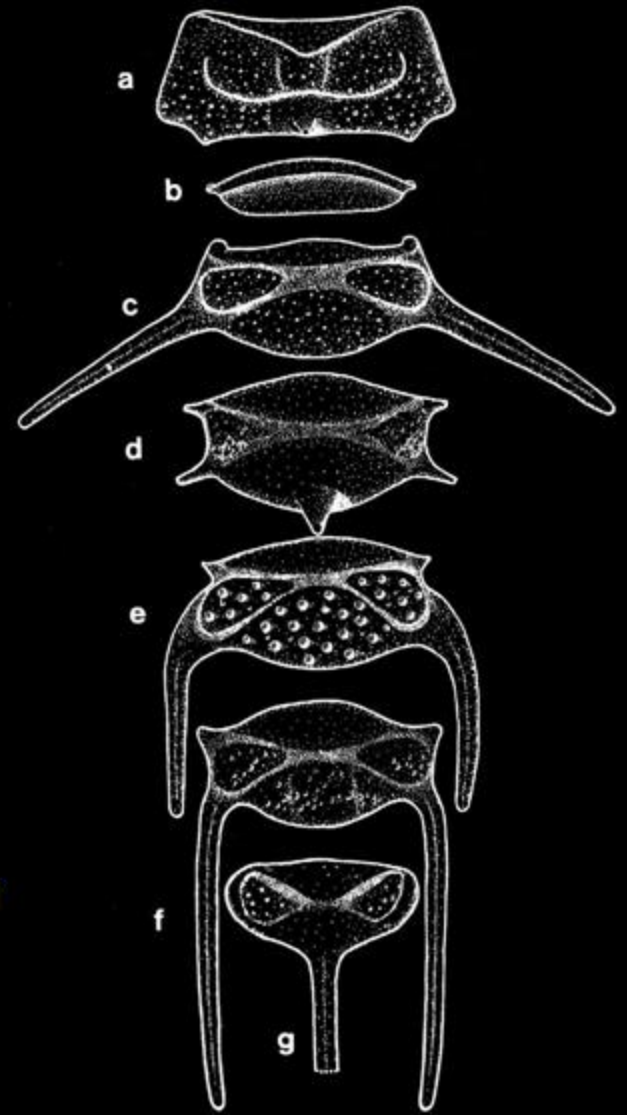
M. malcolmi
BEN BOYD NP, S. COAST NSW [?LATE DEV.]



?Myriapods from Kirawin Formation



New arthropod specimen from Kirawin Formation
Collected March 2010 in a road scrape



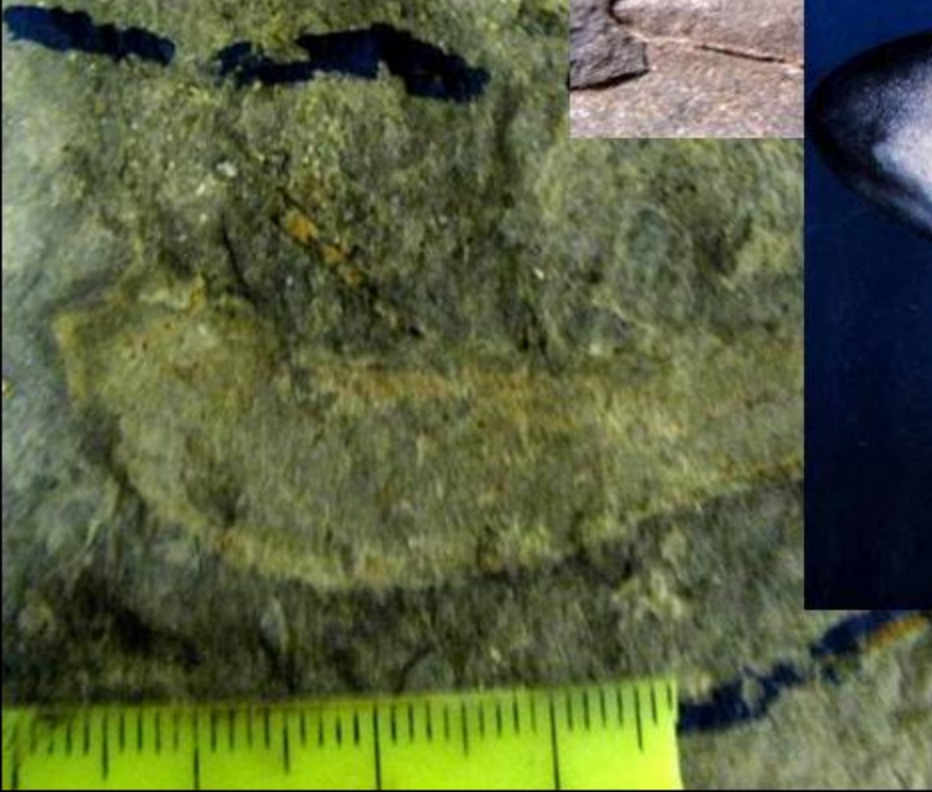
OLDEST SHARK JAW KNOWN FROM THE FOSSIL RECORD

[Pragian stage, Early Devonian]

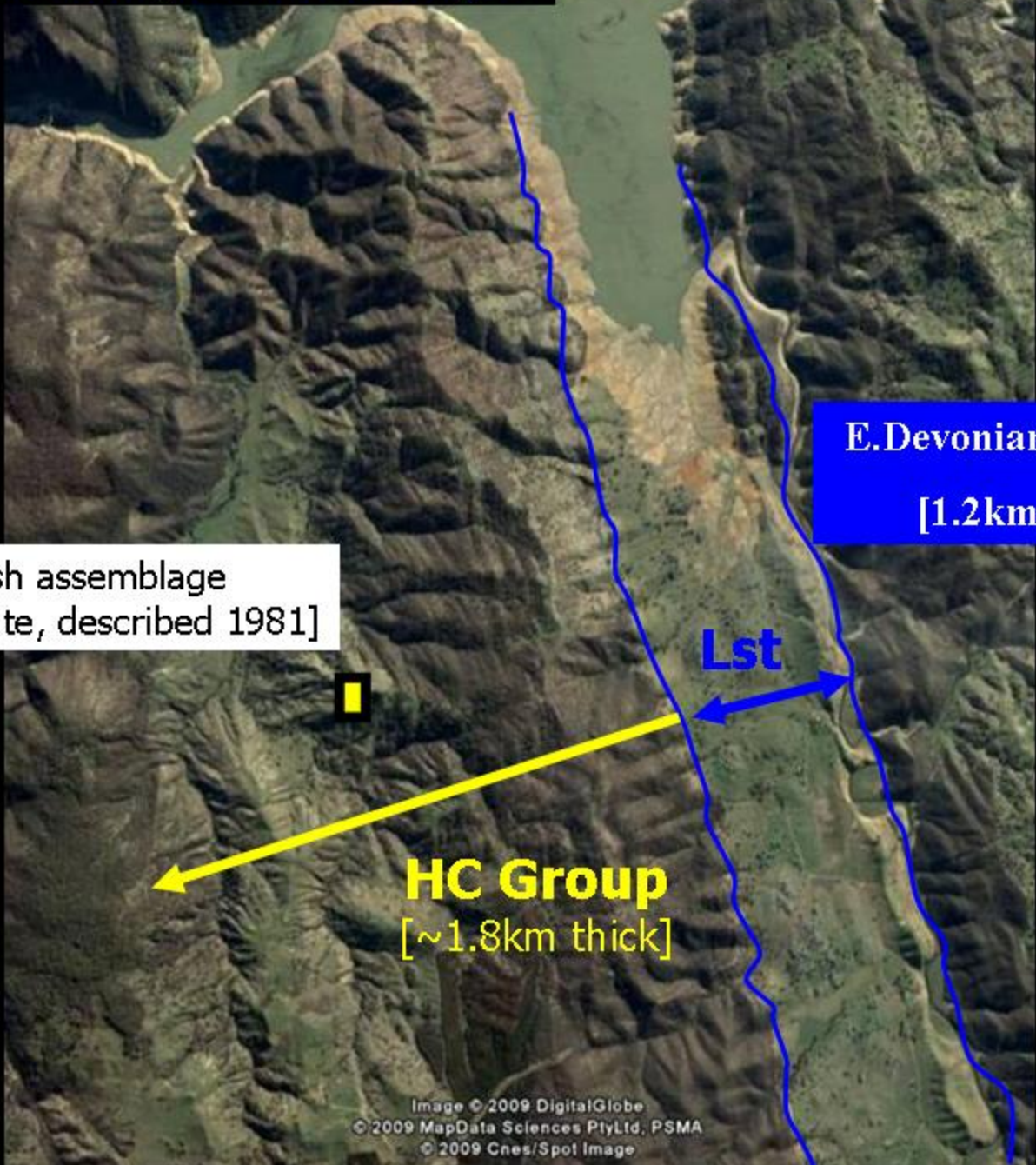
lower jaw of shark *Antarctilamna*
[Mimosa Rocks NP, NSW S. Coast]



tooth of *Antarctilamna*



Goodradigbee valley at Wee Jasper



Fossil Fish assemblage
[Windy Top site, described 1981]

E.Devonian limestone
[1.2km thick]

Lst

HC Group
[~1.8km thick]



Windy Top



James Hunt



OLDEST MEGAPHYLL LEAVES FROM THE FOSSIL RECORD ?



? OLDEST KNOWN DEEP ROOT SYSTEMS FROM THE FOSSIL RECORD



DEVONIAN FOSSIL FISH FROM BURRINJUCK LIMESTONES

- World's most diverse known Devonian vertebrate assemblage [71+ species]
- Exceptional preservation of the early vertebrate braincase
- World's oldest known tropical reef fish assemblage

Bellwood, D.R. 1996. The Eocene fishes of Monte Bolca: the earliest coral reef fish assemblage. *Coral Reefs* 15: 11-19.

Robertson, D. 1998. Do coral-reef fish faunas have a distinctive taxonomic structure? *Coral Reefs* 17: 179-186.











PENTAX

growth

bedding

FISH REMAINS –

very rare, but also easily seen when limestones are washed clean by lake water



Burrinjuck Fossil fish – the London connection

- five specimens sent to London in 1939
- Acid-prepared vertebrate braincase - **first description in scientific literature** [1952]
- collecting trips by British Museum (Natural History) in 1955 and 1963 [**560 specimens** from **139 Burrinjuck sites** taken back to London]
- Largest collection now in Canberra; current faunal list: **70+ species, 60+ genera, 10 orders, 5 classes**

Harry A. Toombs
Head Preparator [Palaeontology]
British Museum (Natural History)



- in 1940's developed the acetic acid technique to extract bones from limestone, **using five fossil fish from Burrinjuck, NSW** [Toombs, 1948, *Mus. Jour. Lond.*]

I. INTRODUCTION

IN 1939, just before the war, Mr. R. Bedford, Director of the Kyancutta Museum, South Australia, sent to the British Museum for identification five specimens showing the remains of fishes that Mr. W. E. Williams, of Cootamundra, New South Wales, had collected from the Middle Devonian marine limestones of the Burrinjuck Dam area, New South Wales, some 35 miles north-west of the federal capital, Canberra.

The specimens eventually proved to be even more interesting and important than was at first supposed, and their discovery reflects great credit on their collector, Mr. W. E. Williams, with whom Mr. Bedford kindly put me in touch. Mr. Williams has now most generously presented them to the British Museum (Natural History)

These then represent three, possibly four, diverse genera of arthrodires, and if we add the *Dipnorhynchus* and the petalichthyid, *Notopetalichthys*, from 'Goodra Vale' (Woodward, 1941—further note below), we have a total of five or six genera of fishes from seven specimens, and it is obvious that in the Burrinjuck area there is to be found a fish-fauna of outstanding importance among those in Devonian strata.

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
GEOLOGY

Vol. 1 No. 9

LONDON: 1952

Dear Mr. Williams,

I expect you will be
happened to us here - Joan
after this morning so I
I have been away for a
came back with the 'plane'
for nearly a fortnight
back to work.

While I was in town I
of the "fish-head" of which I
dorsal surface. I am
to an overseas expert to
about the form as possible.

I hope to get started now
Woolac - I think Joan told
preparation in cutting we have
send you the section as soon
I expect it will be anything between
of continuous work to get a

with kind regards
Yours in

R. Bedford

Dorsal Surface
Head shield of fish
Williamsaspis (Devonian)
Murrumbidgee River.

By R. Bedford Kyancutta. 1938.



Holotype *Williamsaspis bedfordi* White, 1952



Yellow boxfish *Ostracion cubicus*



Spotted boxfish *Ostracion meleagris*

COMPARISONS WITH OTHER DEVONIAN FISH FAUNAS:

- Burrinjuck **64 genera**
- Gogo, WA [KIMBERLEY REEFS, 30 Ma younger] **51 genera**
- Miguasha, Quebec [WORLD HERITAGE SITE] **21 genera**
- Canowindra, NSW **8 genera**

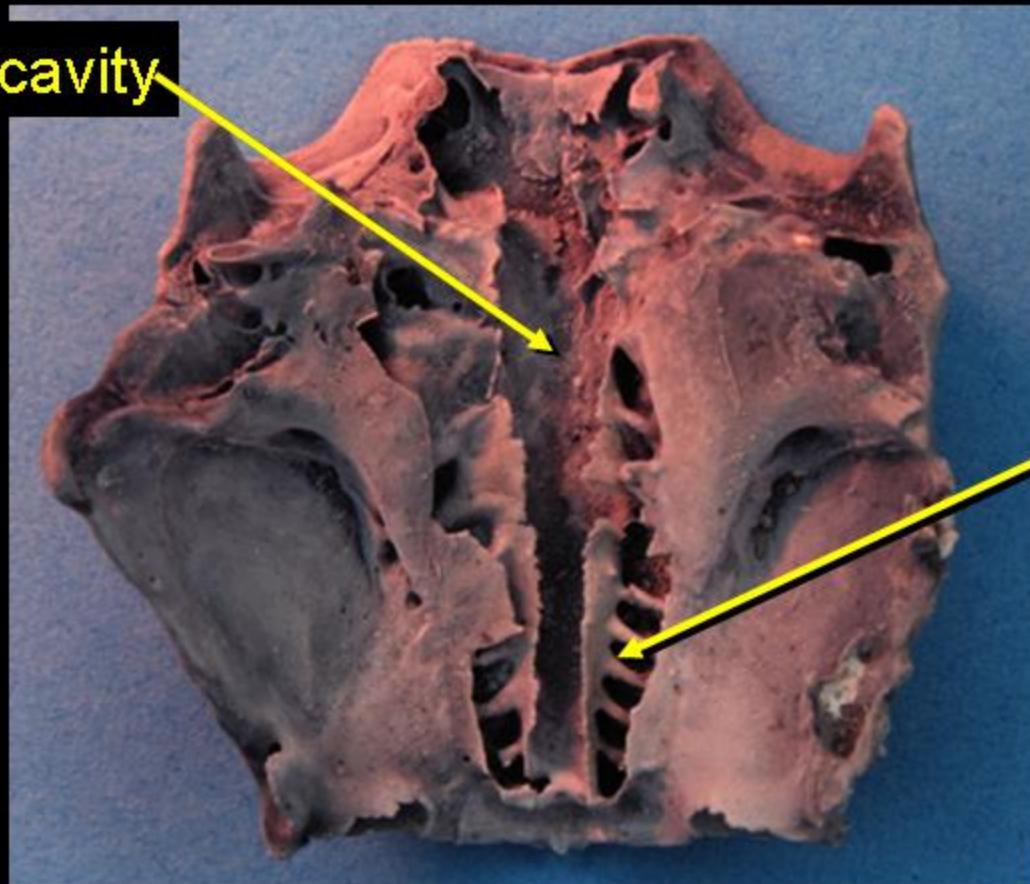


Family Williamsaspidae
Elvaspis tuberculata Young, 2009



**Placoderm fish skull, Early Devonian,
Burrinjuck, NSW [acid prepared]**

Brain cavity

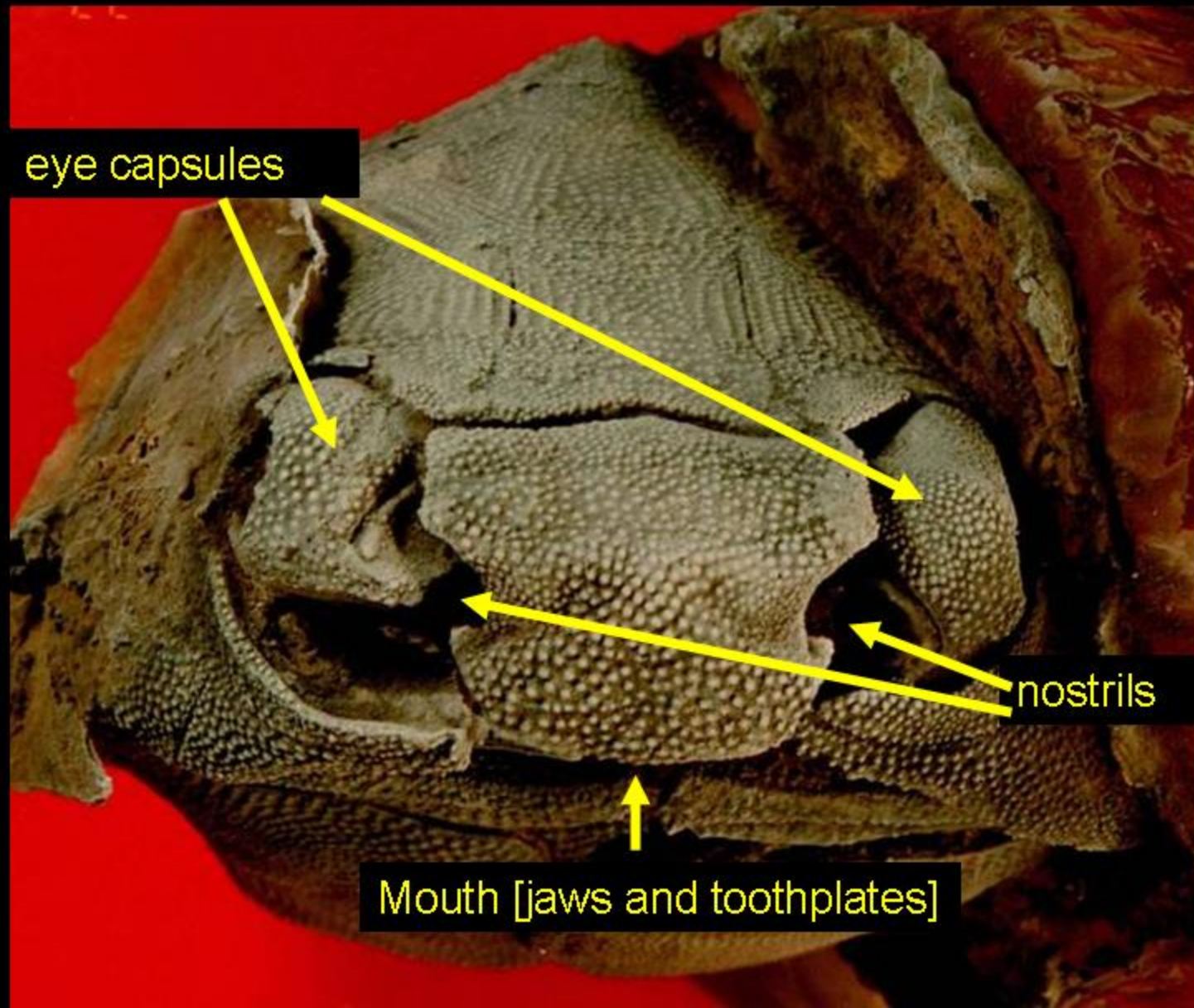


**Cranial nerve
tubes**

**VENTRAL VIEW REVEALING INTERNAL STRUCTURE OF
BRAINCASE**

Complete placoderm fish skull, Burrinjuck, NSW

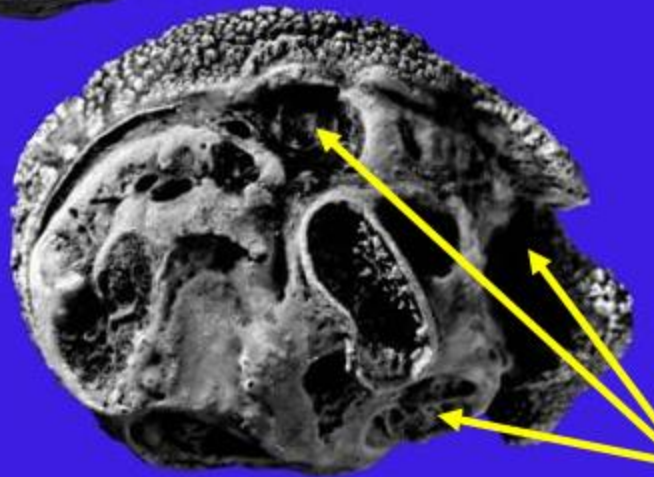
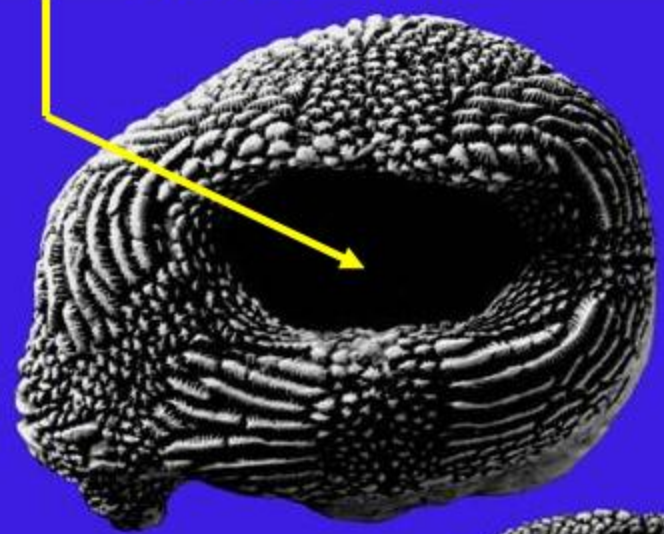
VIEW OF HEAD FROM THE FRONT



**OLDEST COMPLETELY PRESERVED
VERTEBRATE EYE CAPSULE
[~400 million years, Wee Jasper, NSW]**

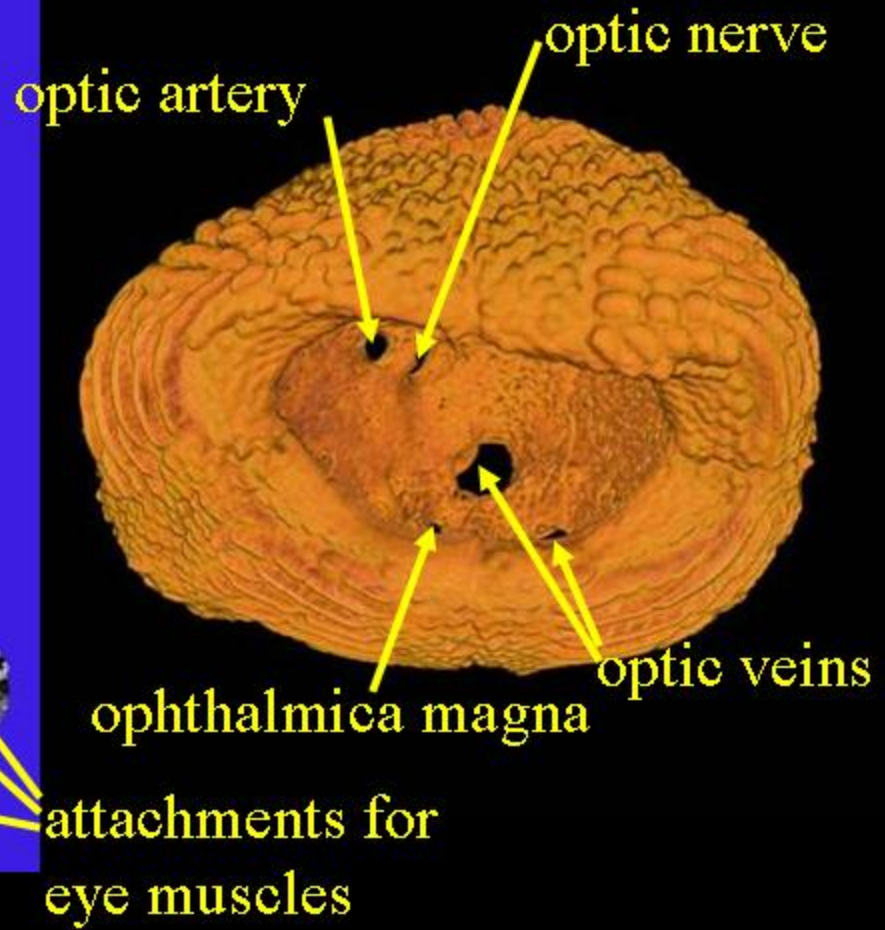
eye opening

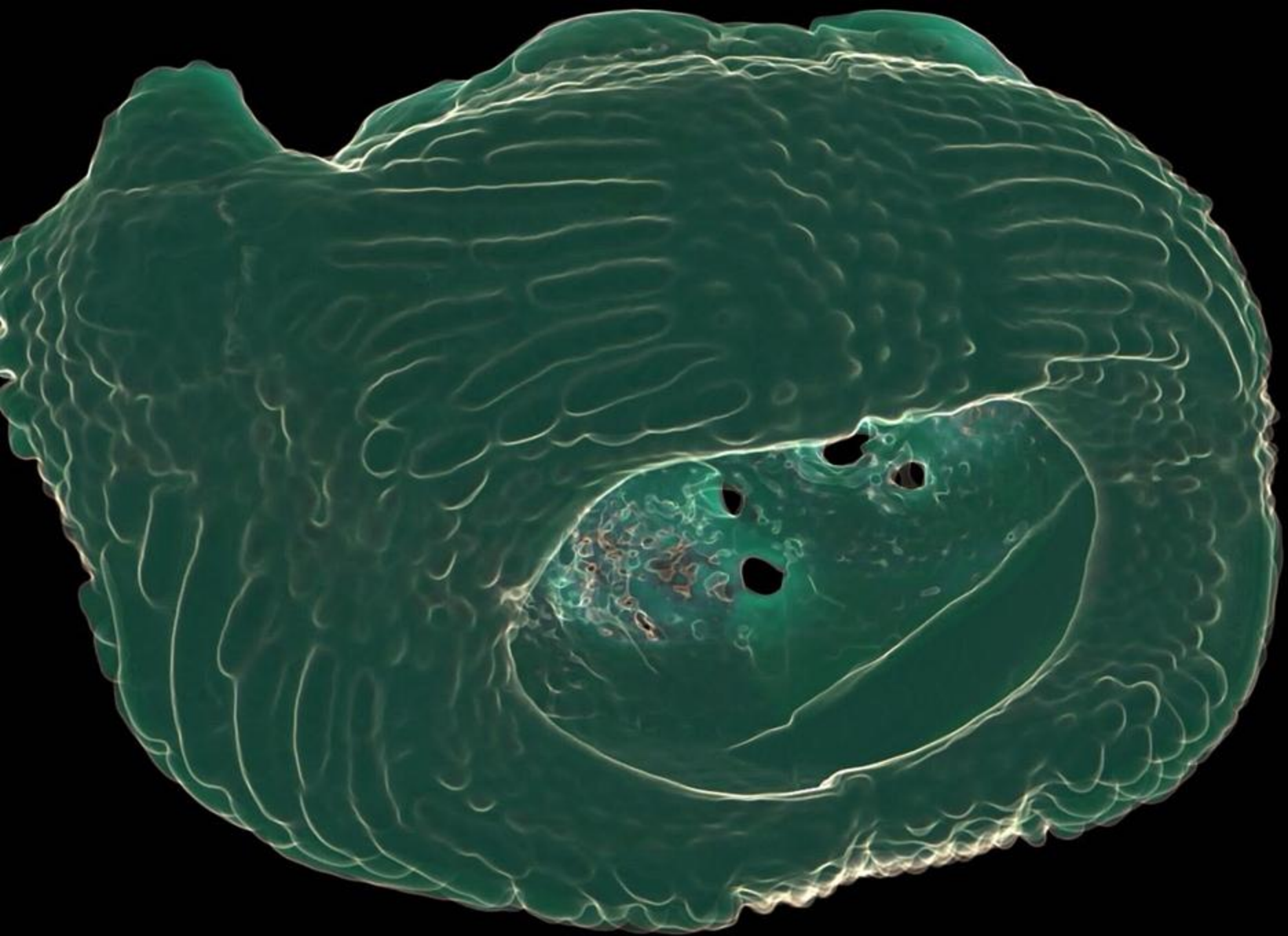
OUTER VIEW



INNER VIEW

**CT SCAN SHOWING
INTERNAL OPENINGS**







'rock exposures ... washed clean by the waters of the lake are more often exposed because of persistent drought conditions ... important skull specimens are more likely to be ... damaged by unauthorised or inexperienced collecting'.

National Heritage Nomination, March 2010




PROTECTION OF BURRINJUCK FOSSIL FISH SITES



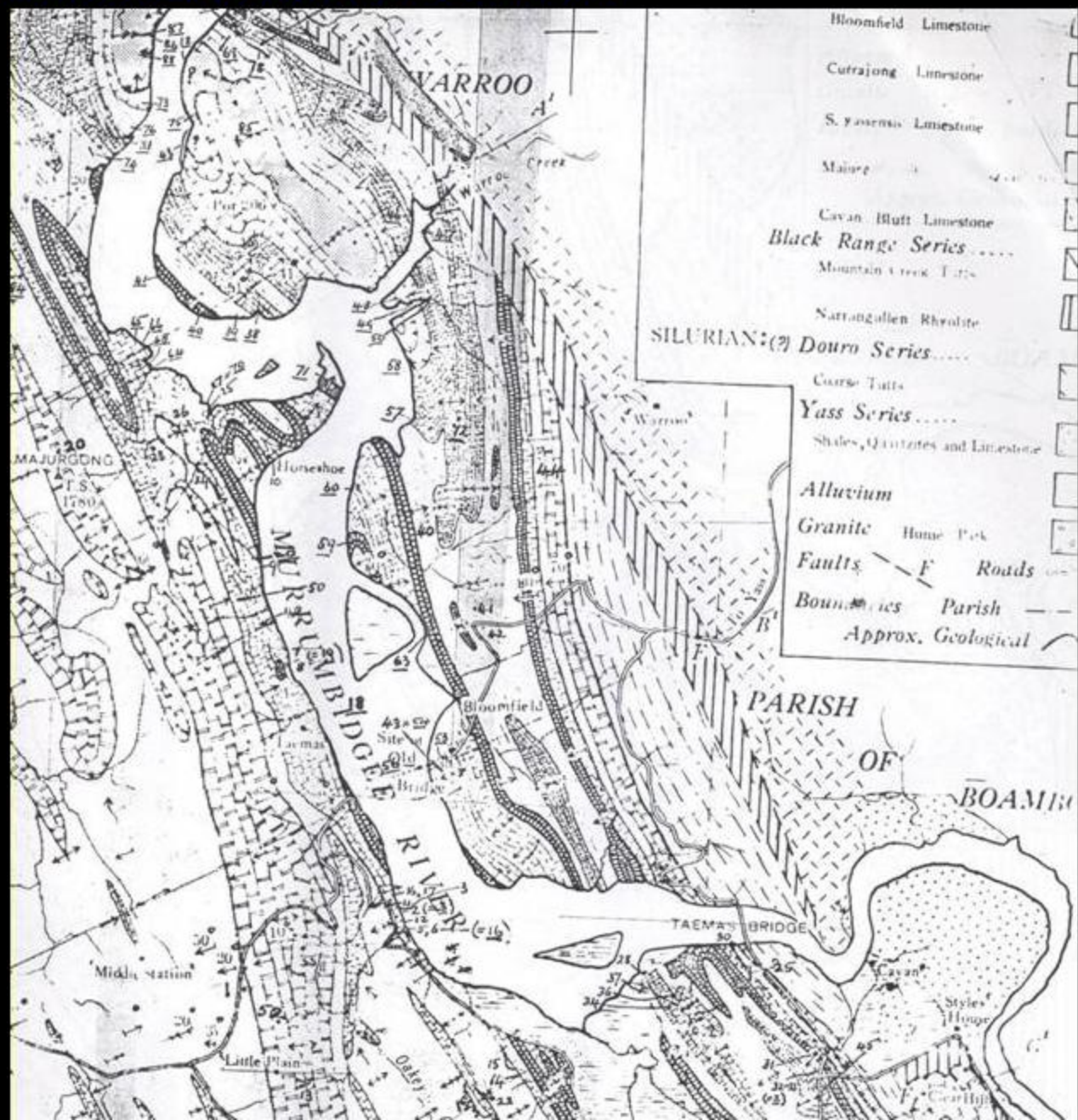
Harry Toombs

H. A. Toombs (1955)
internal report to trustees of British Museum [London]

not seen is difficult of access: a car of the Land Rover type would be essential and even then it is doubtful whether anything like so much material could be collected in the same time again. A factor that has been pointed out to the Australian authorities is the need to discourage casual collecting: weathering is very slow and once an area has been thoroughly searched and the specimens removed from the surface, the possibility of finding more in the future is remote.



Ida Browne (1941, 1959):
 Geological map of the Devonian rocks of Taemas and Cavan.



LOCALITY MAP: National Heritage Nomination, March 2010



Cooradigbee and Cookmundoon Land Owners: principles of engagement for Heritage Listing

- An opportunity to integrate conservation and agriculture without loss of enterprise and personal infrastructure
- Specifically includes only fossil outcrops and caves within the nominated area
- Essential agricultural activities [e.g. bushfire hazard, weed, or feral animal control] to continue in paddocks housing fossil outcrops
- Heritage value improved by responsible removal of fossil specimens, to be housed in Wee Jasper or ANU campus or institutional equivalent [cf. '*significant impact guidelines 1.1*', *Environmental Protection and Biodiversity Conservation Act 1999*]

Some outstanding issues for the future

- Negotiation with land-owners covering the eastern limestone outcrop [Taemas-Cavan] to support a future **STAGE II nomination** based on a successful outcome for the current nomination
- Financial support for a ‘**Wee Jasper Visitor Center**’, including interactive displays, and properly housed and curated on-site fossil collections.
- Long term protection of the ANU Burrinjuck collection of fragile irreplaceable 400 m.yr. old vertebrate braincase specimens
[**Australia is the only country in the developed world without a museum for natural history collections in its National Capital!**]
- Unsatisfactory situation for general fossil collections at Australian National University to be addressed [geological curator position abolished 10 years ago]
- Future repatriation from London of type specimens and representative material of Burrinjuck Devonian fossil fish held by the British Natural History Museum

Acknowledgments

Thanks to **Helen and Ian Cathles** [Wee Jasper] for supporting our research and the Heritage Application, **Ben Young, Bob Dunstone**, for field and laboratory assistance, **Tim Senden** for XCT scanning, and **Ajay Limaye** for *Drishti* 3D visualisation, **Jane Ambrose & colleagues** for advice on National Heritage nomination.

Research funded by ARC Discovery Grants:

DP 0558499 '*Australia's exceptional Palaeozoic fossil fishes, and a Gondwana origin for land vertebrates*' [G.C. Young, J.A. Long 2005-2007];

DP 0772138 '*Old brains, new data – early evolution of structural complexity in the vertebrate head*' [G.C. Young, T. Senden, J.A. Long 2007-2010]



Onychodus [LOBE-FINNE
TETRAPODOMORPH FISH]



EARLY DEVONIAN ?AMPHIBIAN
VERTEBRAE FROM CAVAN, N.S.W.