Hot Science Cool Talks

UT Environmental Science Institute

70

Your Inner Fish

Dr. Neil Shubin

February 25, 2011

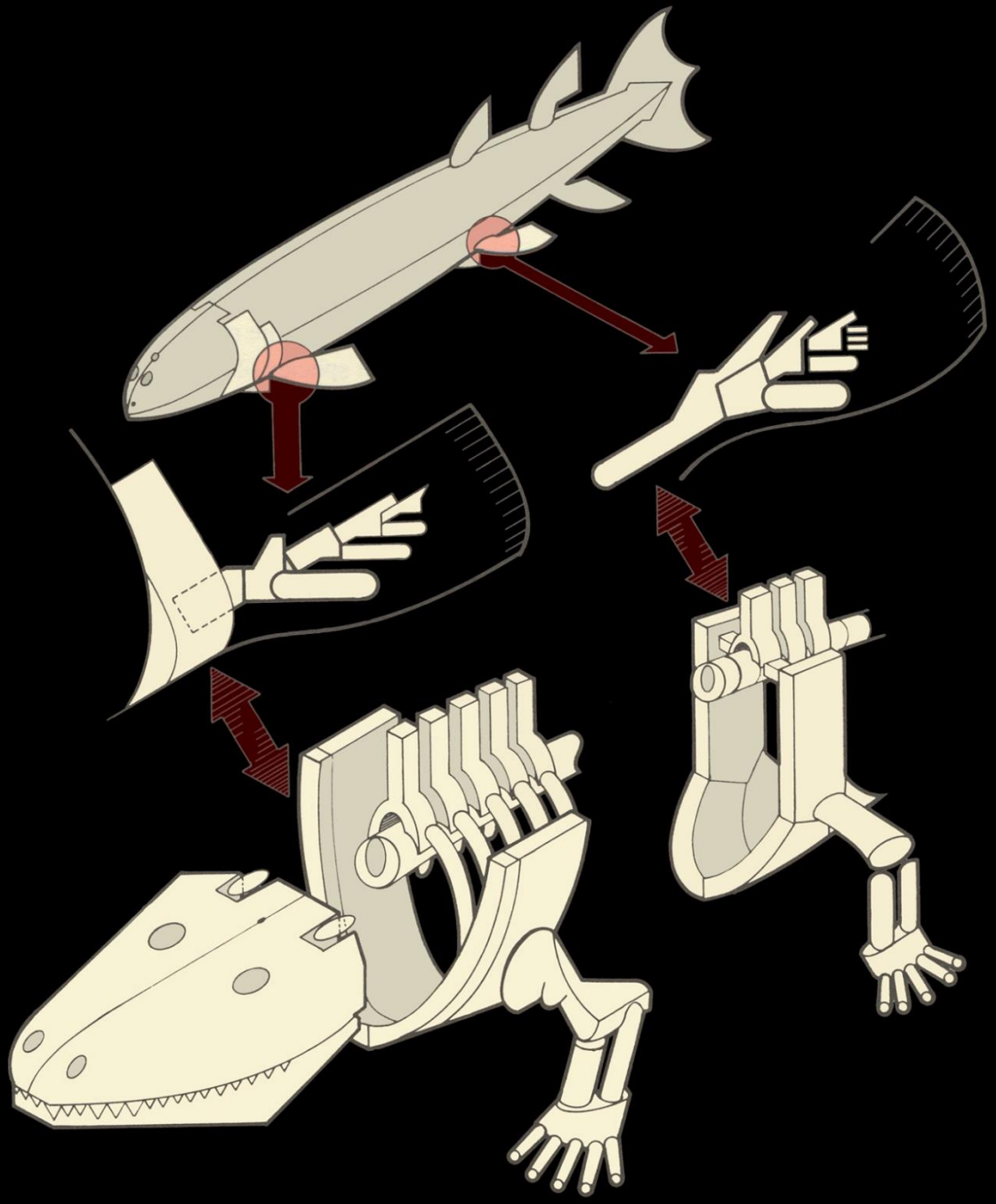
Your Inner Fish

Neil Shubin

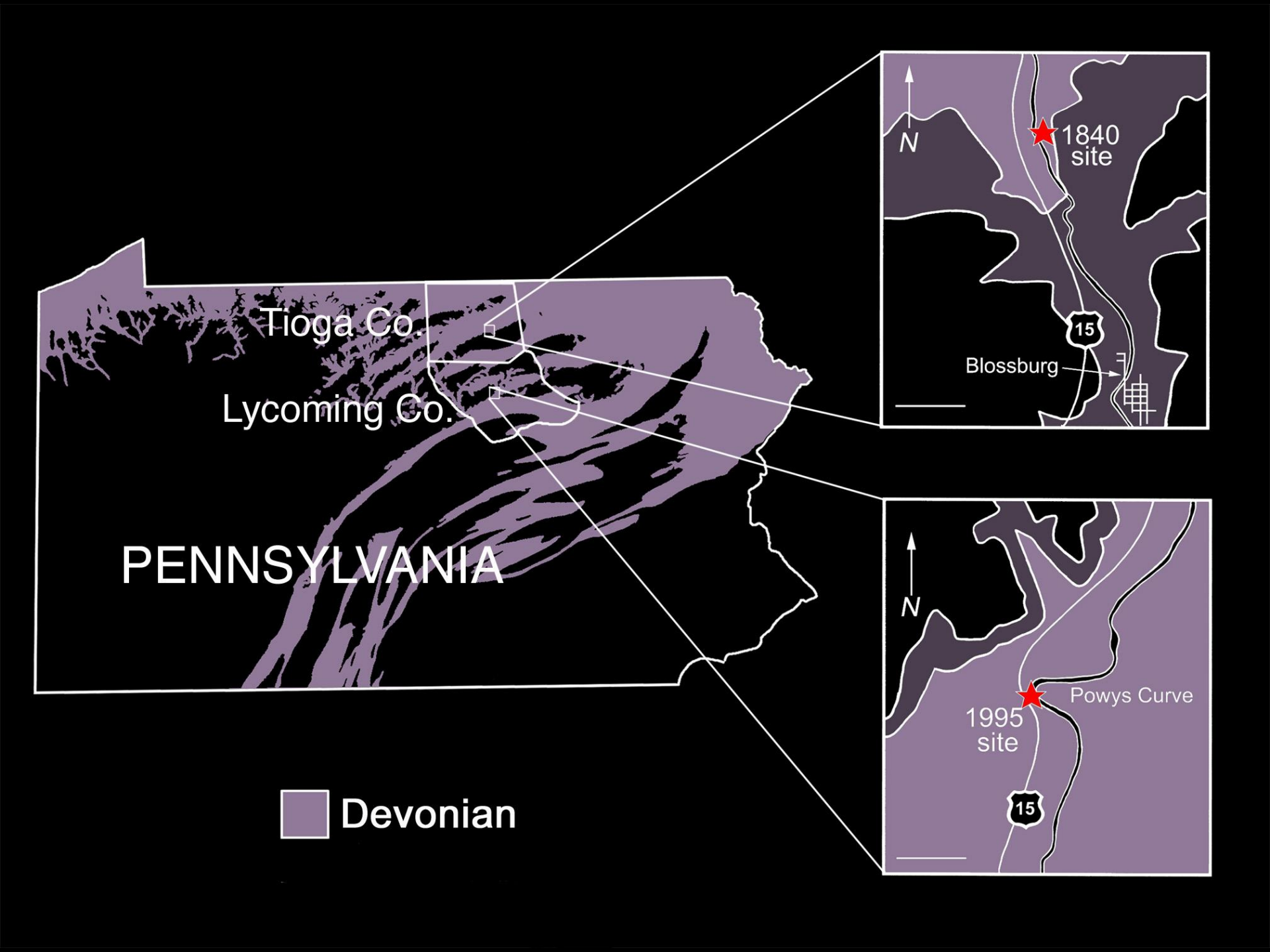
Associate Dean and Bensley Professor of
Organismal Biology and Anatomy
The University of Chicago

March 25, 2011


Finding
Your Inner Fish



modified from Radinsky 1987


Tioga Co.
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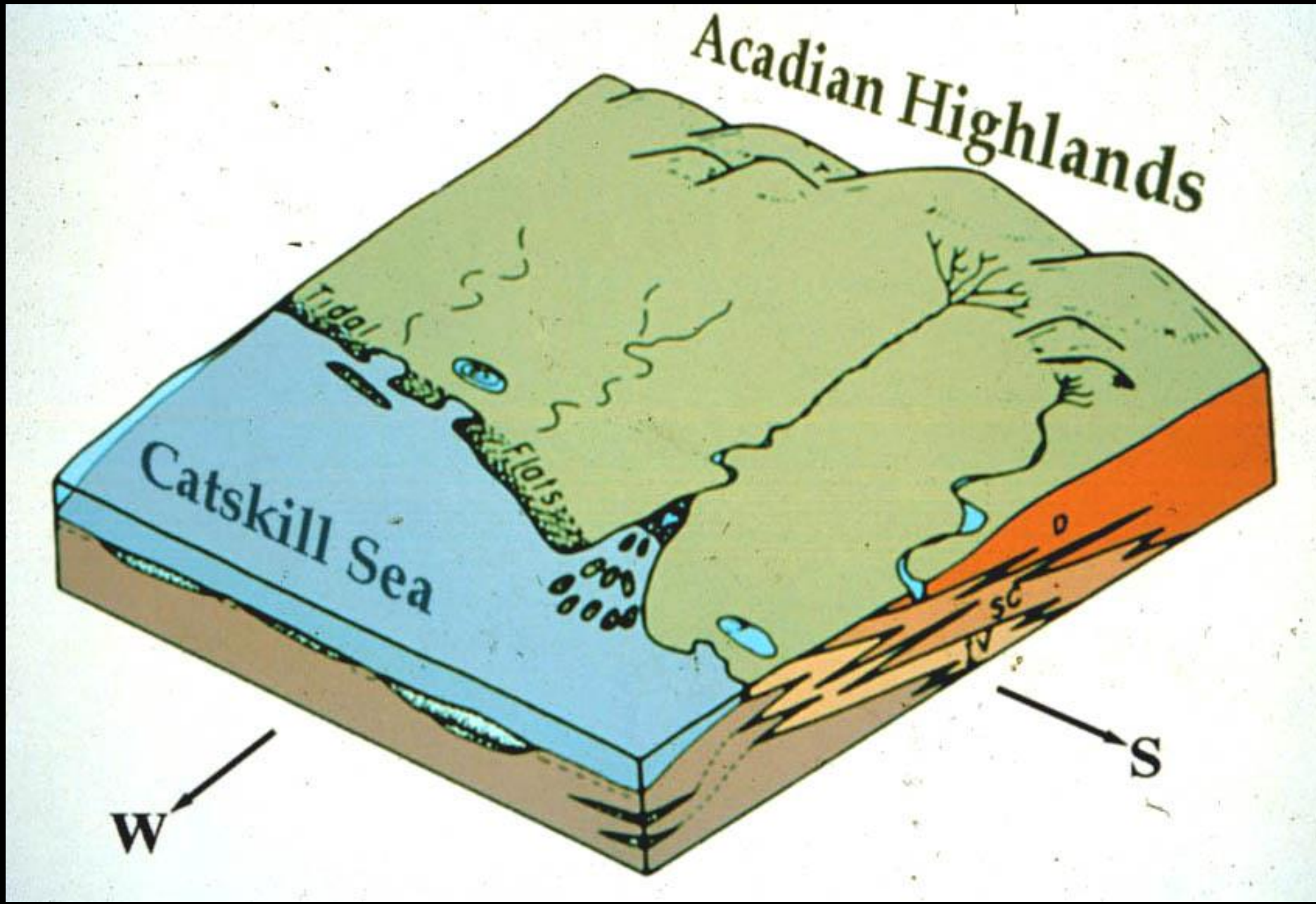
Acadian Highlands
Tidal
Flats
Catskill Sea
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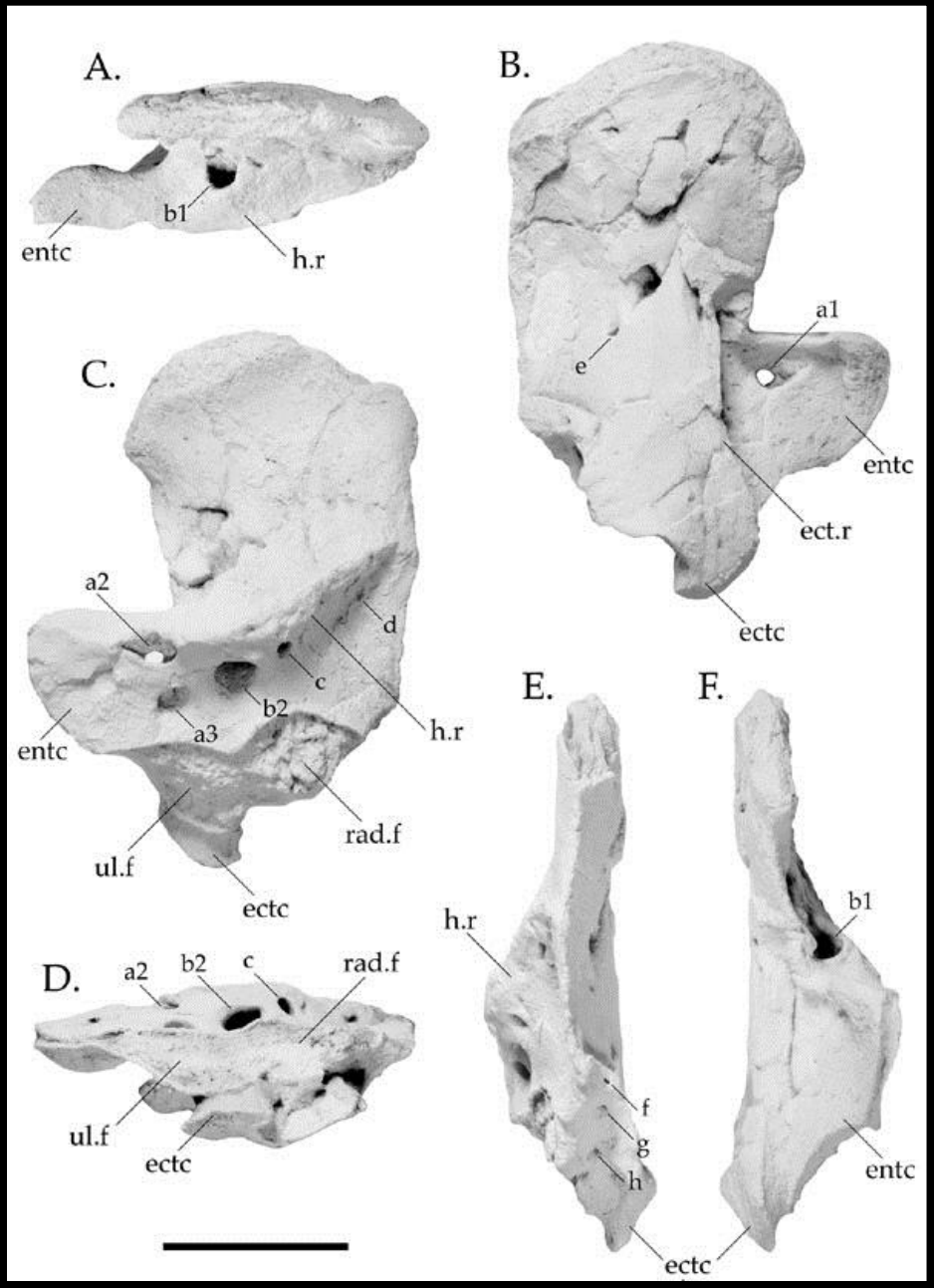
2 April 2004
Science
Vol. 304 No. 5667
Pages 1–152 $10
AAAS


A.
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b1
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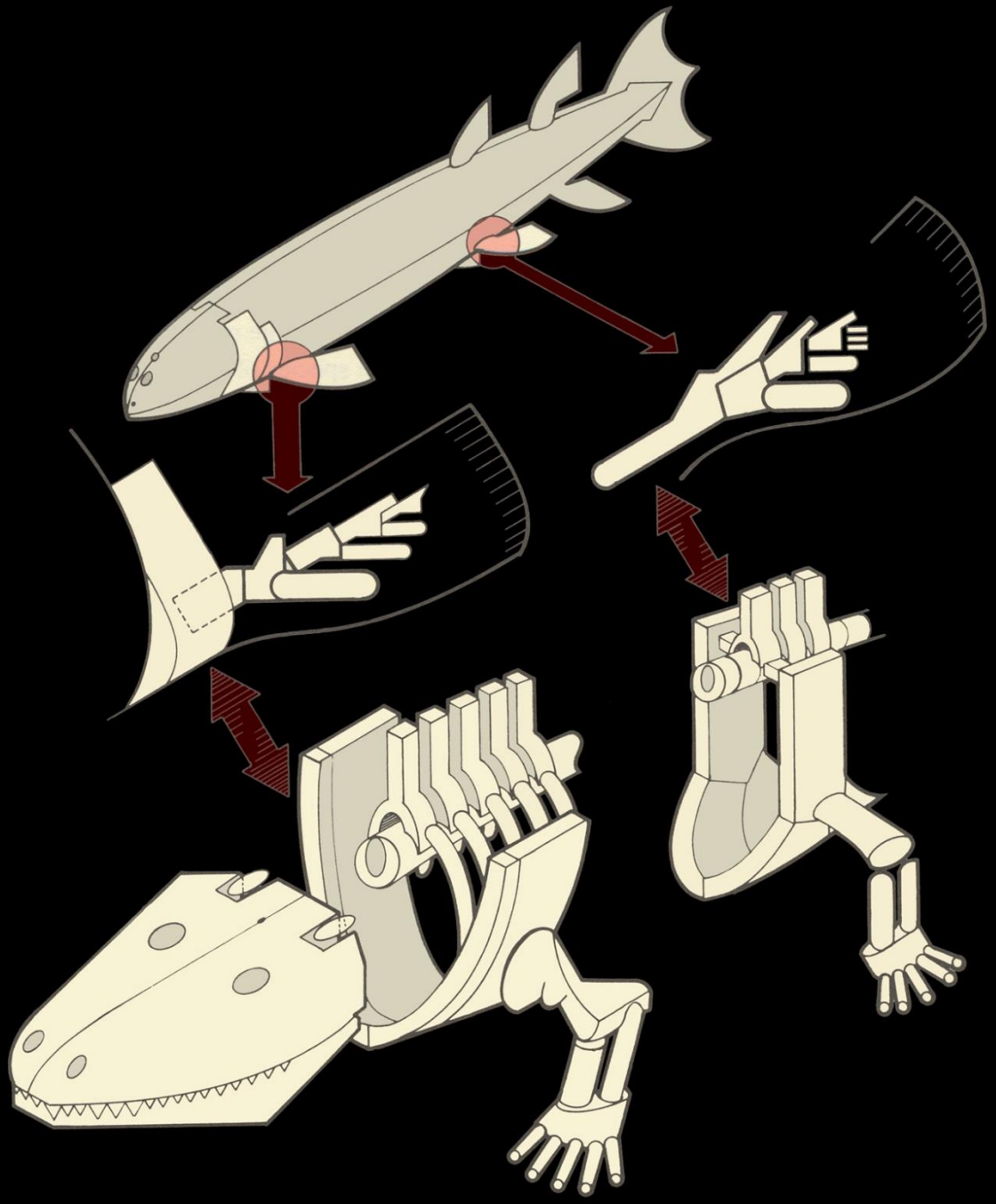

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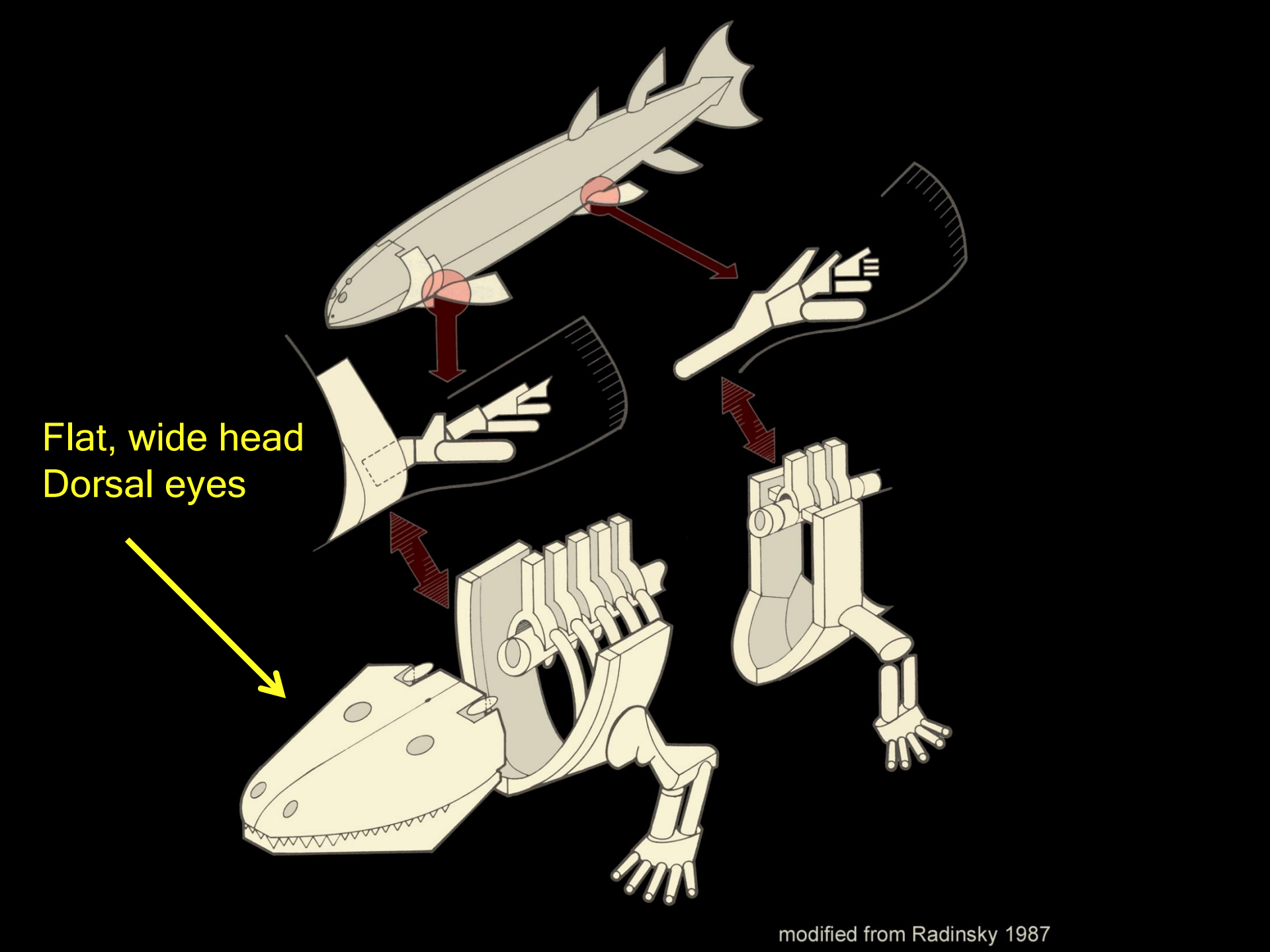
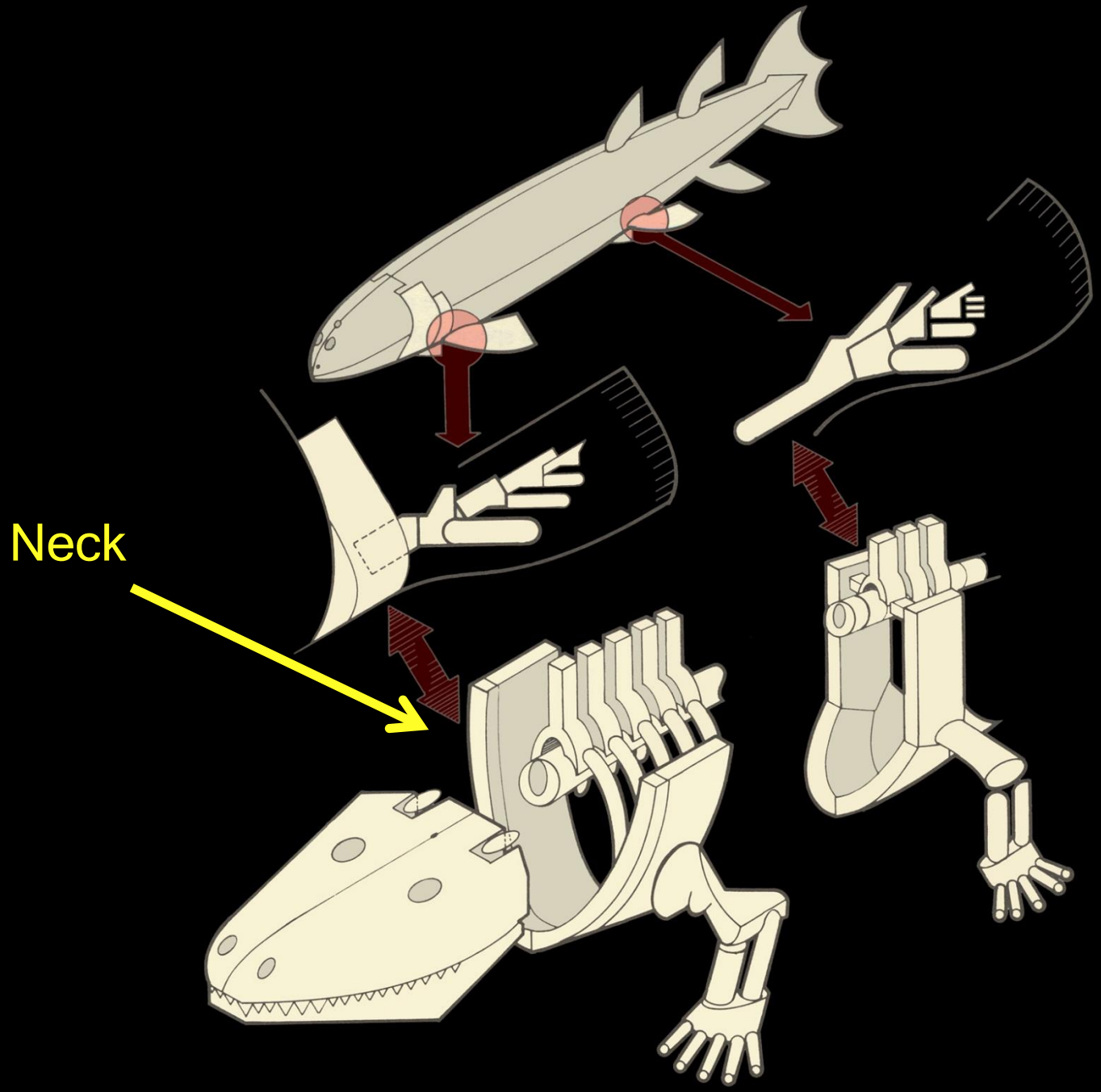

Flat, wide head
Dorsal eyes
modified from Radinsky 1987



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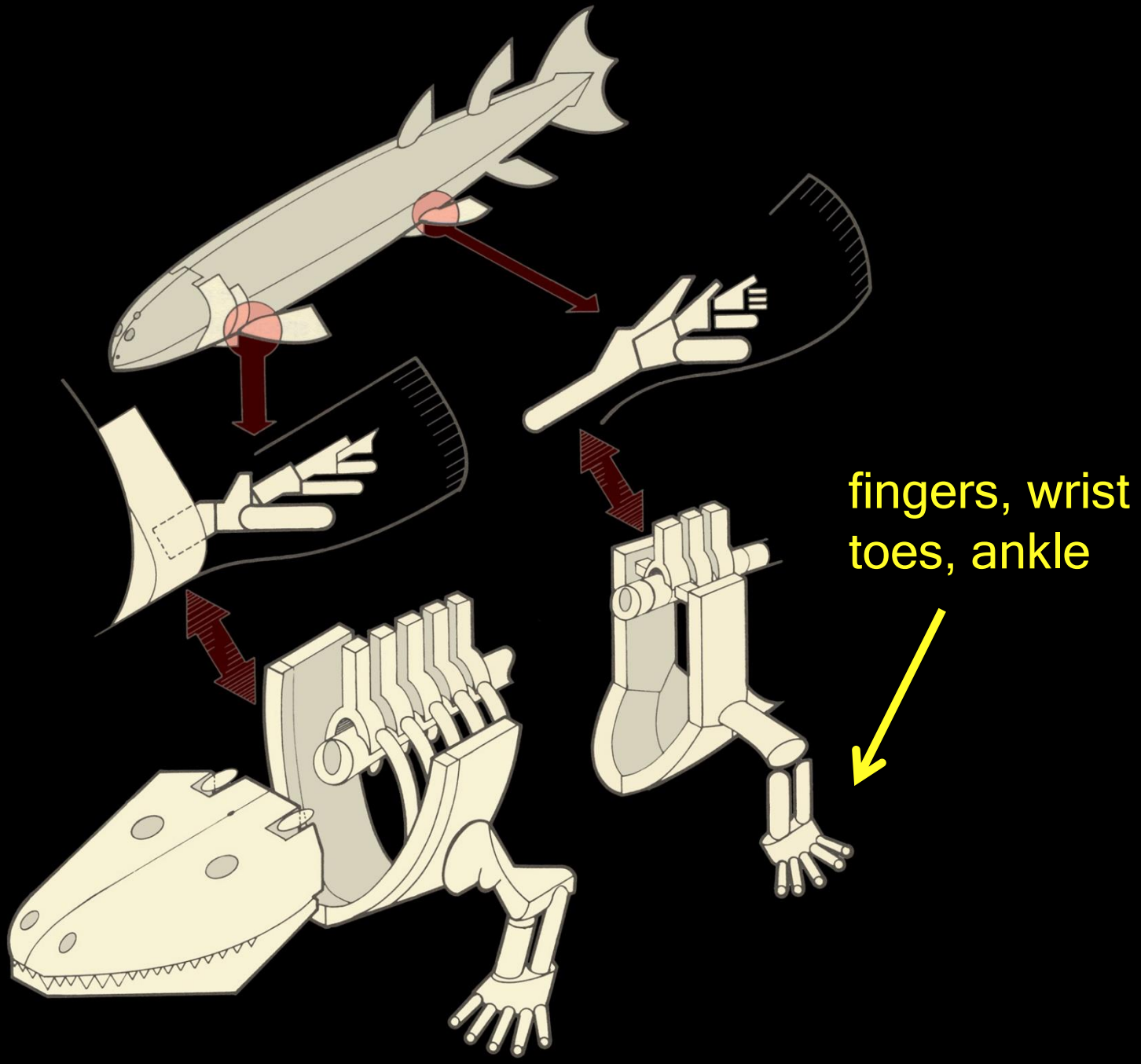
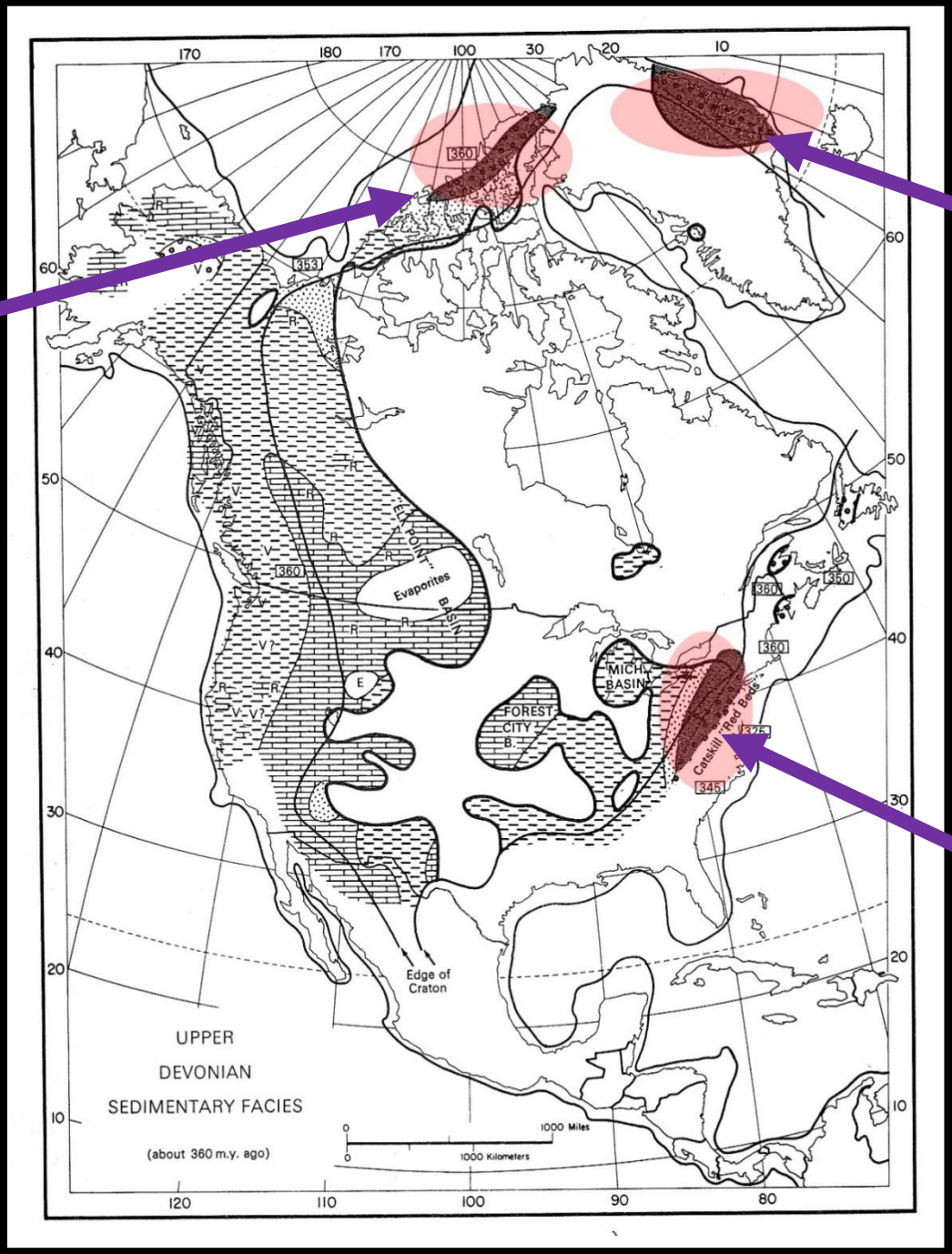


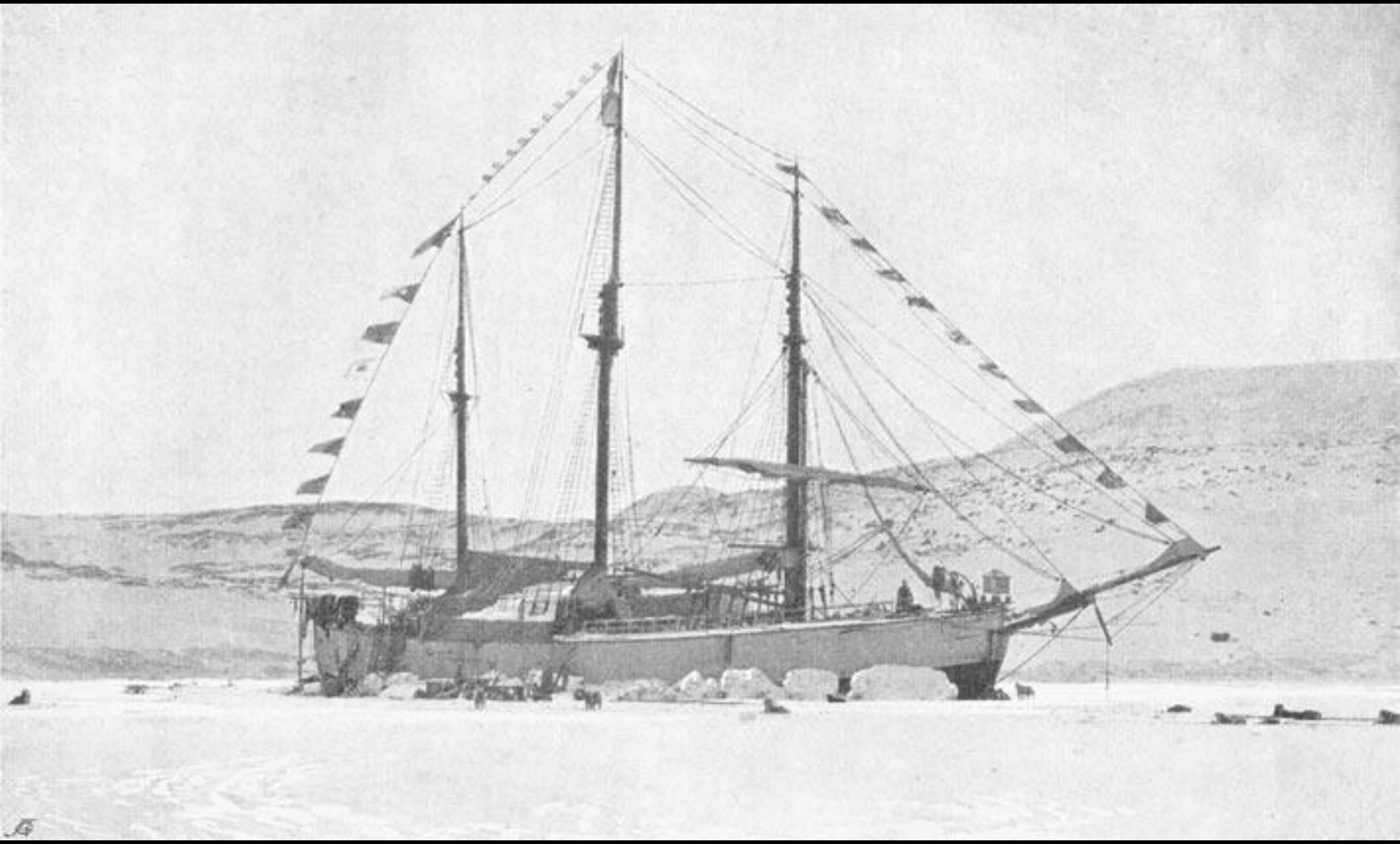
modified from Radinsky 1987

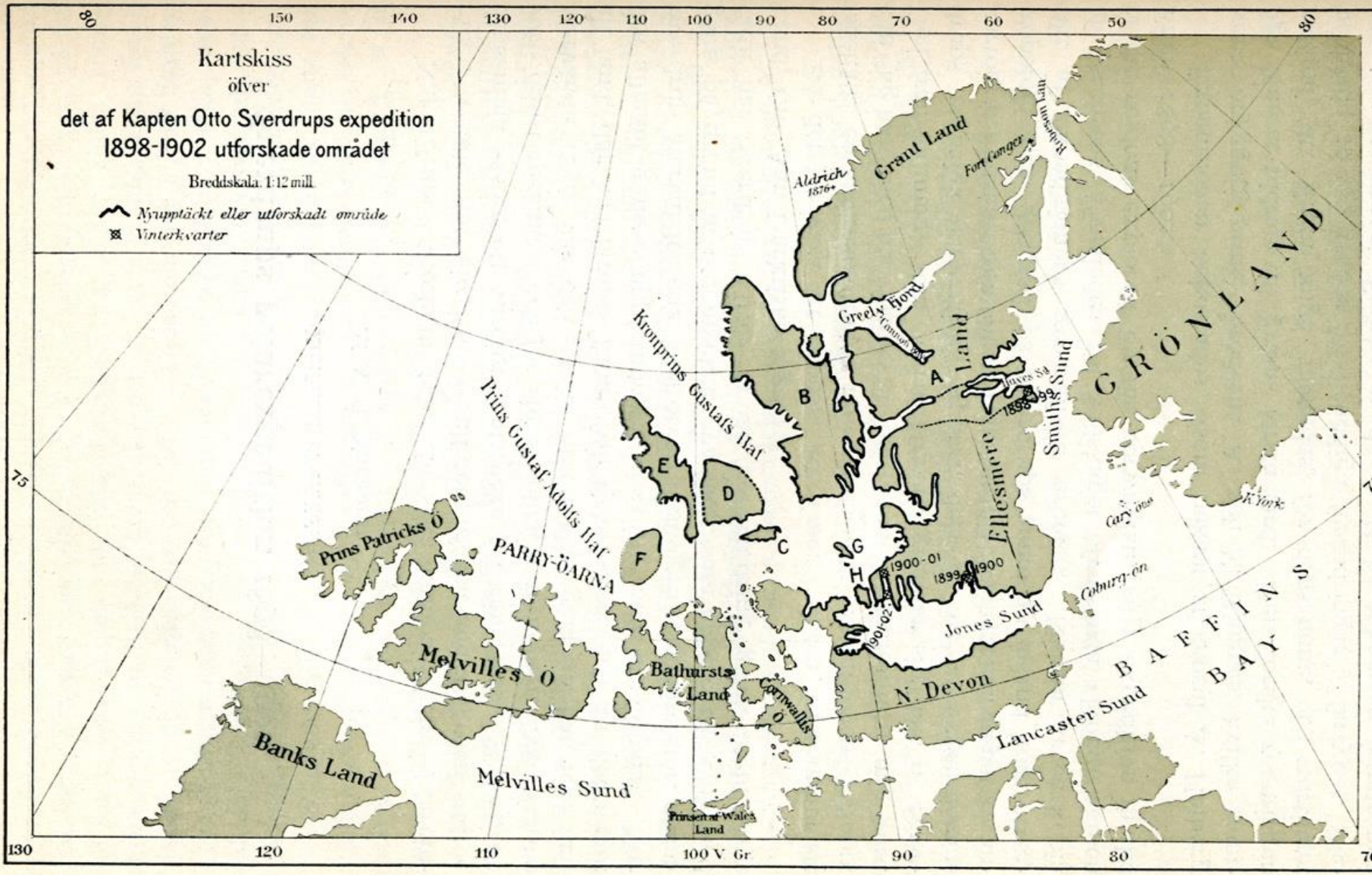
SECOND EDITION

EVOLUTION OF THE EARTH

ROBERT H. DOTT, JR.
ROGER L. BATTEN


Arctic Islands unexplored
East Greenland well studied
Ongoing Catskill Project
UPPER DEVONIAN SEDIMENTARY FACIES
(about 360 m.y. ago)
Evaporites
MICH. BASIN
FOREST CITY B.
Catskill Red Beds
Edge of Craton
1000 Miles
1000 Kilometers




Kartskiss
öfver
det af Kapten Otto Sverdrups expedition
1898-1902 utforskade området
Breddskala 1:12 mill.
Nyupptäckt eller utforskadt område
Vinterkvarter
80
150
140
130
120
110
100
90
80
70
60
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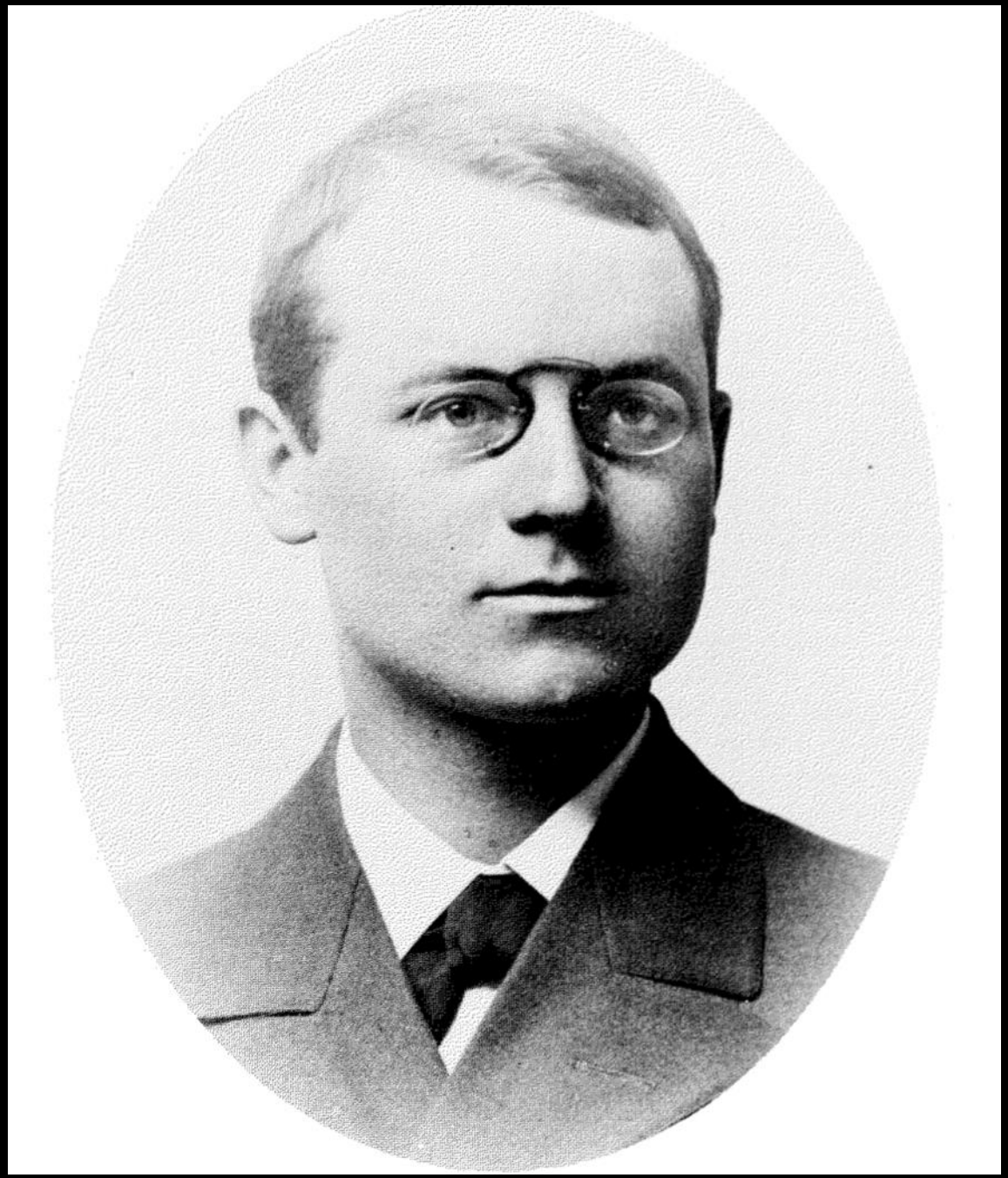
80
75
130
120
110
100 V. Gr.
90
80
70
Grant Land
Aldrich 1876
Fort Conger
Robeson Kan.
Greely fjord
Kronprins Gustafs Haf
Prins Gustaf Adolfs Haf
PARRY-ÖARNA
A
B
C
D
E
F
G
H
Land
Ellesmere
Smiths Sund
GRÖNLAND
Jakes Sd
1898-99
Cary Öns
K. York
Prins Patricks Ö
Melvilles Ö
Bathursts Land
Cornwallis Ö
1900-01
1899-1900
1901-02
Jones Sund
Coburg-ön
N. Devon
Lancaster Sund
BAFFINS BAY
Banks Land
Melvilles Sund
Prinsen af Wales Land



BULLETIN OF CANADIAN PETROLEUM GEOLOGY
VOL. 24, NO. 4 (DECEMBER 1976), P. 485-639

THE MIDDLE-UPPER DEVONIAN CLASTIC WEDGE OF THE FRANKLINIAN GEOSYNCLINE

ASHTON EMBRY[1] AND J. EDWARD KLOVAN[2]

[1] a, 335 - 8th Avenue S.W., Calgary, Alberta.
[2] nt of Geology, University of Calgary, Calgary, Alberta.

Composition — Fine-grained sandstones in the Fram Fm are quartz arenites and quartzose lithic arenites (Plate 24, Fig. 4). The average composition of five fine-grained sandstones from the type section is 70 ± 3 per cent quartz; 1 ± 1 per cent feldspar; 5 ± 2 per cent rock fragments (mainly shale); 6 ± 2 per cent chert; 12 ± 3 per cent clay (mainly kaolinite, minor illite and chlorite); 3 ± 3 per cent calcite; 2 ± 2 per cent porosity. Biotite and muscovite are also present and are usually concentrated in dark laminations along with carbonaceous material. Heavy minerals are rare and consist mainly of tourmaline, zircon, rutile and garnet. Most grains are subround.

Part of the quartz content is authigenic cement. The clay is interpreted to be mainly of diagenetic origin and tends to occur in the coarser sandstones. Sparry calcite is clearly a cement and is most common in very fine grained sandstones and coarse siltstones. The samples point counted had a fairly low calcite content (max. 9 per cent) but others range as high as 30 per cent.

The average composition of five shales from the type Fram Fm is 65 ± 6 per cent quartz; 3 ± 1 per cent feldspar; 15 ± 4 per cent kaolinite; 12 ± 3 per cent illite; 1 ± 1 per cent chlorite; and 1 ± 1 per cent calcite.

Paleocurrents — Cross-beds were measured throughout the type section of the Fram Fm. The paleocurrent pattern (Fig. 30) is unimodal and indicates sediment transport to the southwest. Visual estimates of cross-bed orientation on eastern Grinnell Peninsula suggest a similar sediment transport direction.

Age — Palynological control is limited to spot samples collected near the base, middle and top of the formation of both the type section and the east Grinnell Peninsula locality. The available data indicate an age of Early to Middle Frasnian (*Medius* and *Maclarenii* zones) (Chi, *pers. comm.*, 1975). Plant and fish collections made by the Fram expedition also indicate a Late Devonian age (Nathorst, 1904; Kiaer, 1915).

Environment of Deposition — The lithologies, sedimentary structures, cyclicity and fossil content of the Fram Fm suggest a meandering-stream environment of deposition. Sandstone units are interpreted to be point-bar and channel-fill deposits, whereas the shale-siltstone units are of overbank origin.

The Fram Fm is similar to the Catskill Fm of Pennsylvania (*pers. obs.*), which is also interpreted to be of meandering-stream origin (Allen and Friend, 1968). The main lithologic difference between the two is

---

PLATE 24

Fig. 1. Basal conglomeratic portion of sandstone unit in Fram Fm, Bird Fiord area. Note basal scour surface and plant fragments (upper right) in sandstone.

Fig. 2. Siltstone with root markings, Fram Fm, Bird Fiord area.

Fig. 3. Siltstone with mud cracks, Fram Fm, Bird Fiord area.

Fig. 4. Photomicrograph of fine-grained, quartzose lithic arenite from Fram Fm, Bird Fiord area.

PLATE 23

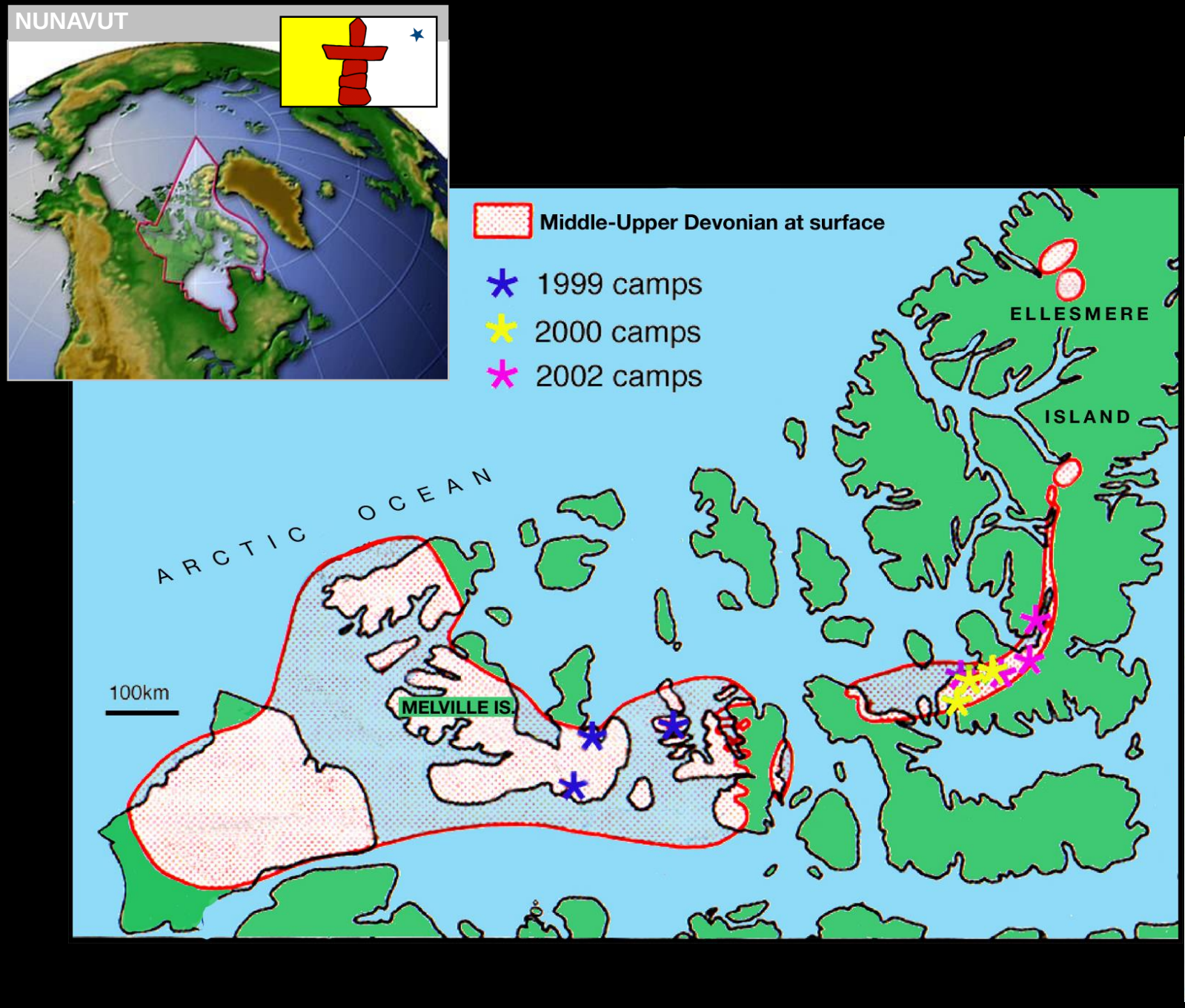
Fig. 1. Alternating resistant sandstone units and recessive shale units. Detailed examination revealed that the lithologies are arranged in fining-upward cycles. The sandstone units pictured here are each about 3 m (10 ft) thick. Fram Fm, Bird Fiord area.

Fig. 2. Thin sandstone unit in lower portion of Fram Fm, Bird Fiord area. Note abrupt basal contact and gradational upper contact.

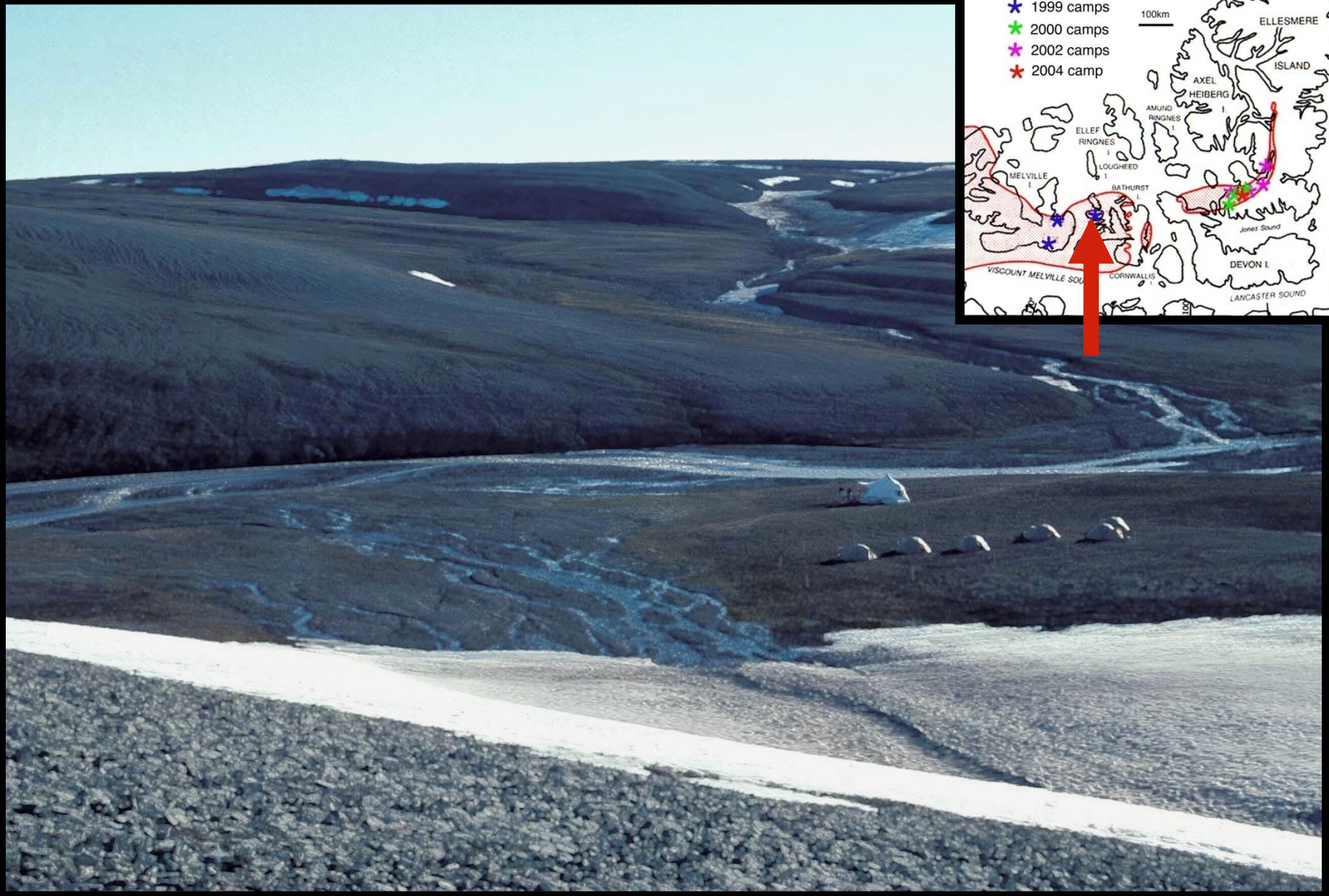
Fig. 3. Trough cross-beds in sandstone unit of Fram Fm, Bird Fiord area. Dave Christie for scale.

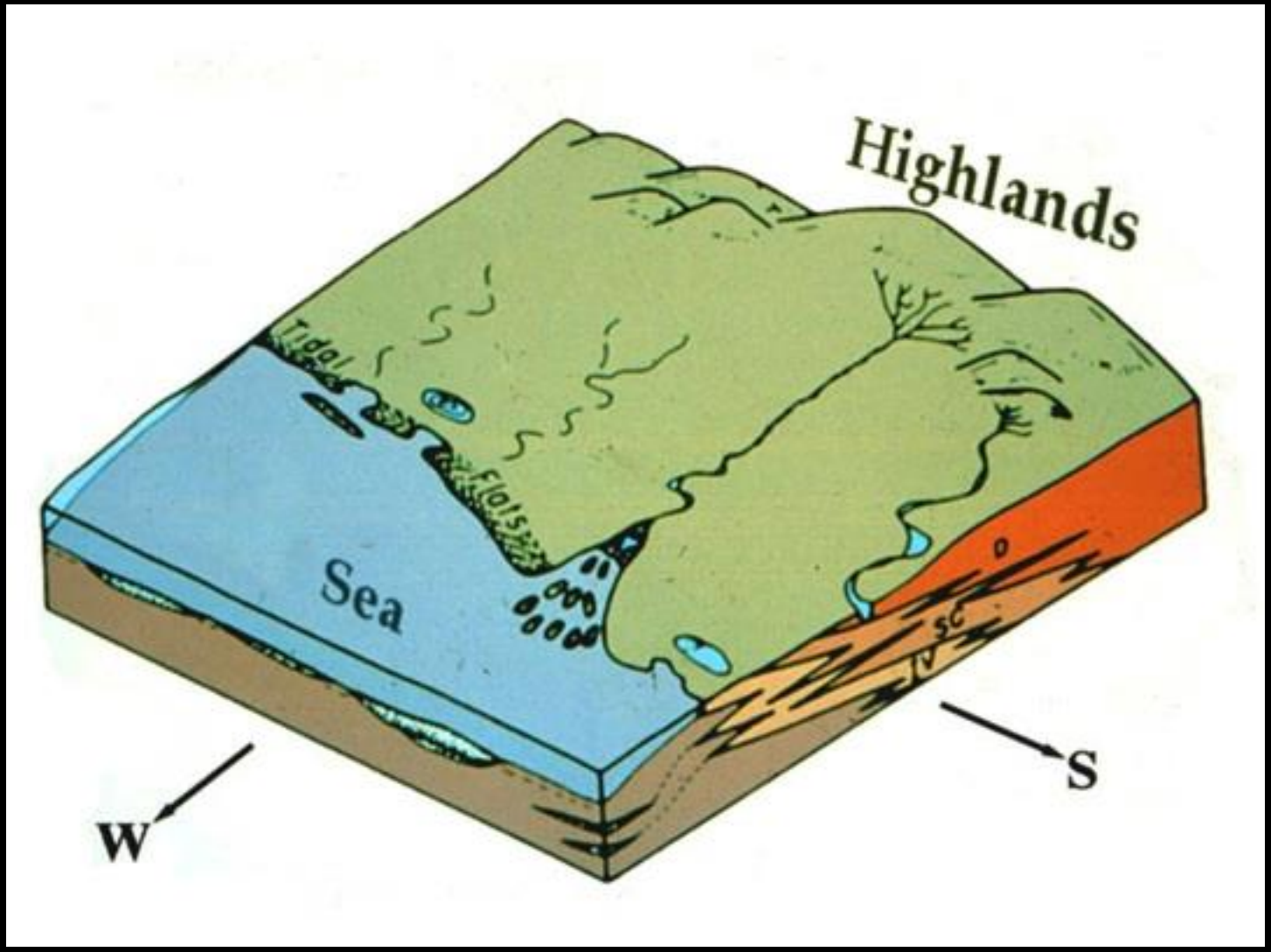
Fig. 4. Sandstone channel fill in Fram Fm, Bird Fiord area. Note onlapping of beds. Dave Christie for scale.

PLATE 23


NUNAVUT
Middle-Upper Devonian at surface
1999 camps
2000 camps
2002 camps
ELLESMERE
ISLAND
ARCTIC OCEAN
100km
MELVILLE IS.
AGE
SOUTHERN ELLESMERE ISLAND
DEVONIAN
LATE
MIDDLE
FAMENNIAN
FRASNIAN
GIVETIAN
EIFELIAN
NORDSTRAND POINT FORMATION
HELL GATE FM.
FRAM FM.
HECLA BAY FORMATION
STRATHCONA FIORD FM.
UPPER BIRD FIORD FORMATION
LOWER BIRD FIORD FORMATION

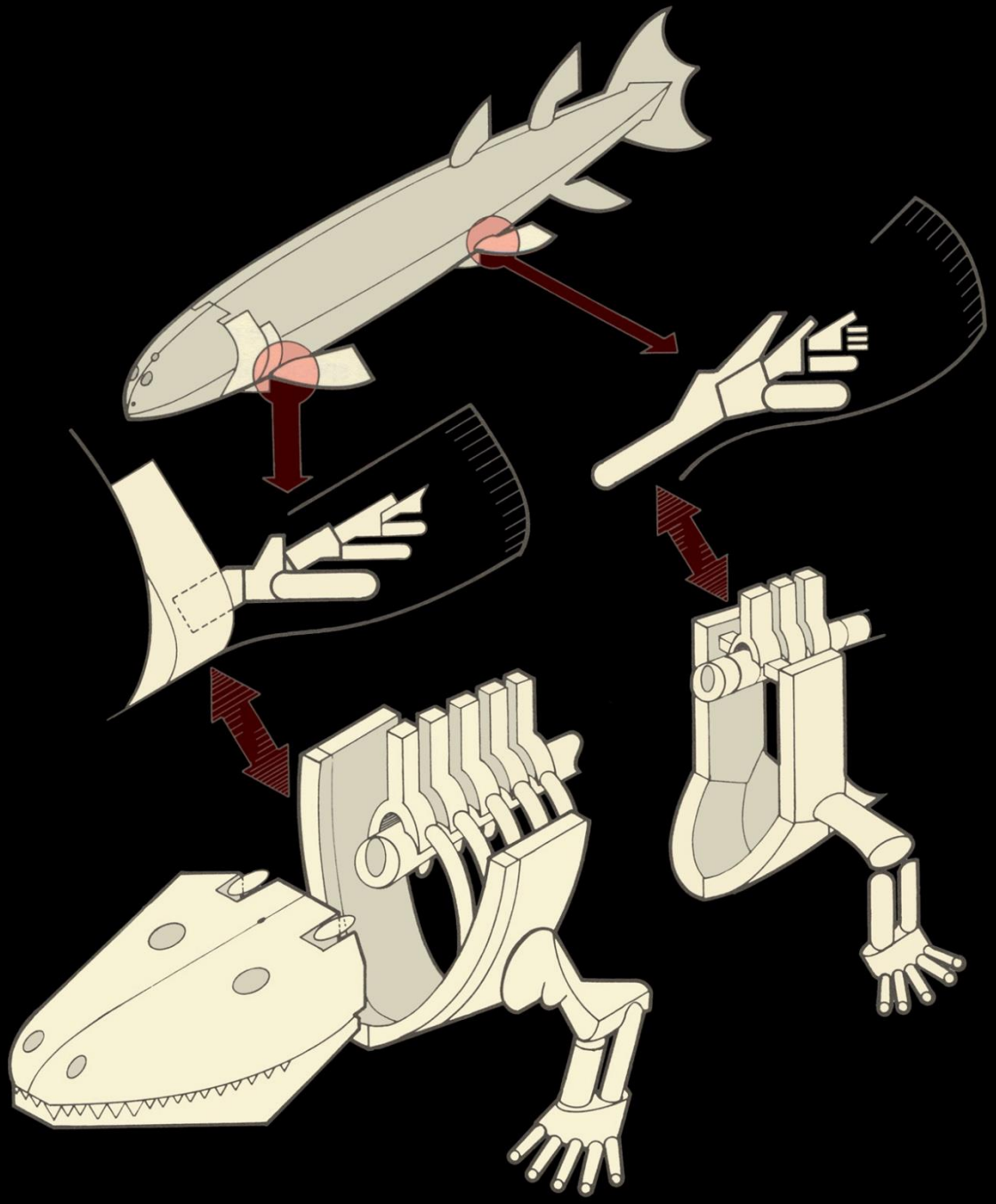

© 2006 Europa Technologies
Image © 2006 NASA
Image © 2006 TerraMetrics
©2006 Google
Pointer 34°50'37.86" N 90°08'24.03" W
Streaming 100%
Eye alt 5380.21 mi


Middle-Upper Devonian clastic wedge at surface or in subsurface
1999 camps
2000 camps
2002 camps
2004 camp
100km
ELLESMERE ISLAND
AXEL HEIBERG I.
AMUND RINGNES I.
ELLEF RINGNES I.
LOUGHEED I.
MELVILLE I.
BATHURST I.
Jones Sound
DEVON I.
CORNWALLIS I.
LANCASTER SOUND


Highlands
Tidal
Flats
Sea
W
S


Middle-Upper Devonian clastic wedge at surface or in subsurface
1999 camps
2000 camps
2002 camps
2004 camp
100km
ELLESMERE ISLAND
AXEL HEIBERG I.
AMUND RINGNES I.
ELLEF RINGNES I.
LOUGHEED I.
MELVILLE I.
BATHURST I.
VISCOUNT MELVILLE SOUND
CORNWALLIS I.
DEVON I.
LANCASTER SOUND

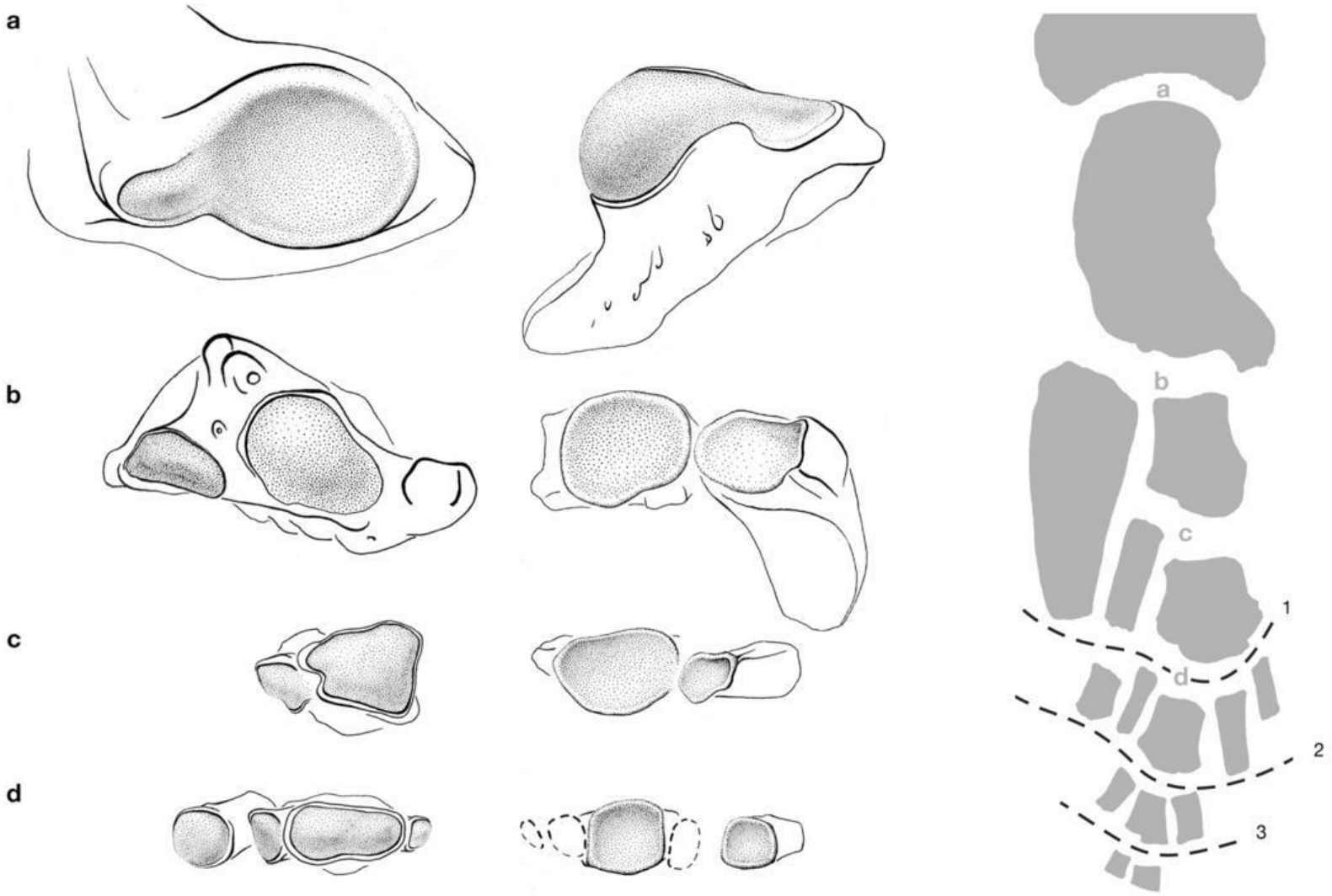
Site NV2K17, southern Ellesmere Island, 2006



modified from Radinsky 1987

Tiktaalik

Large Freshwater Fish
(Inuktituk)



Illustrations by: Kalliopi Monoyios

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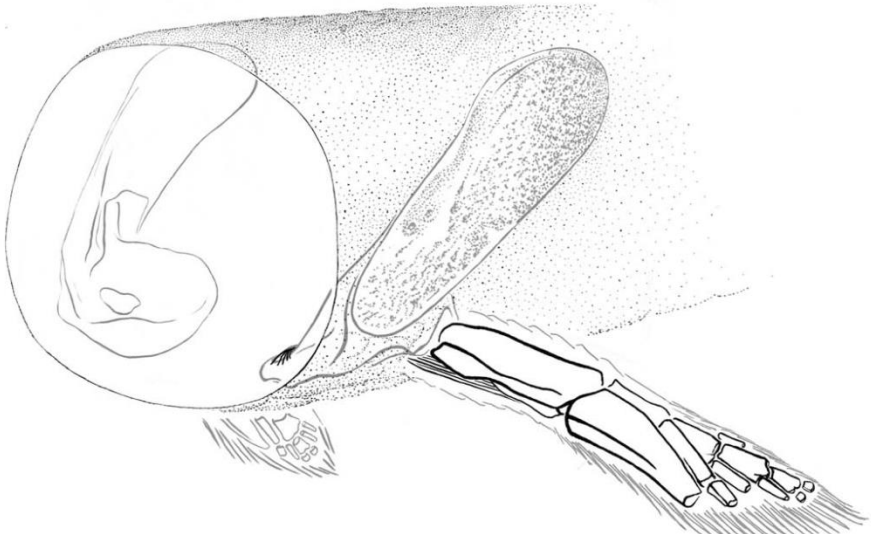

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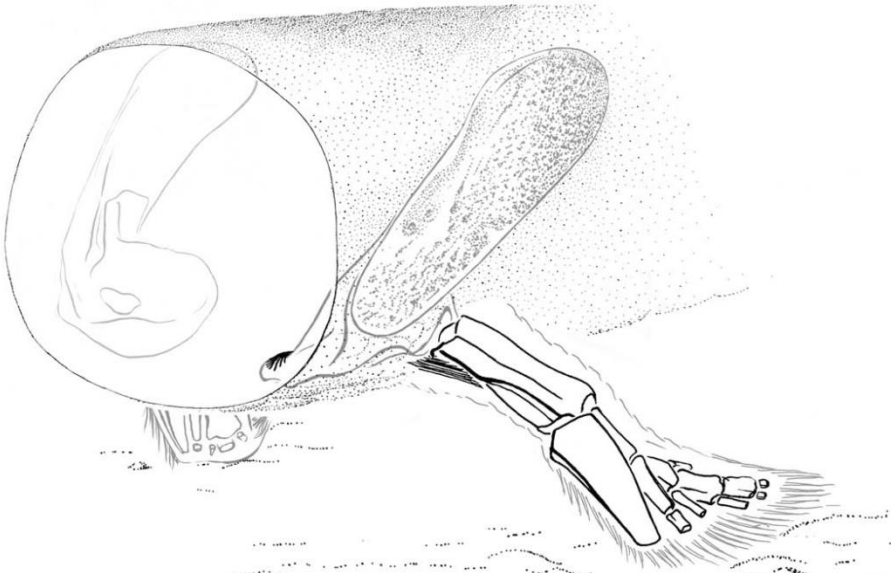
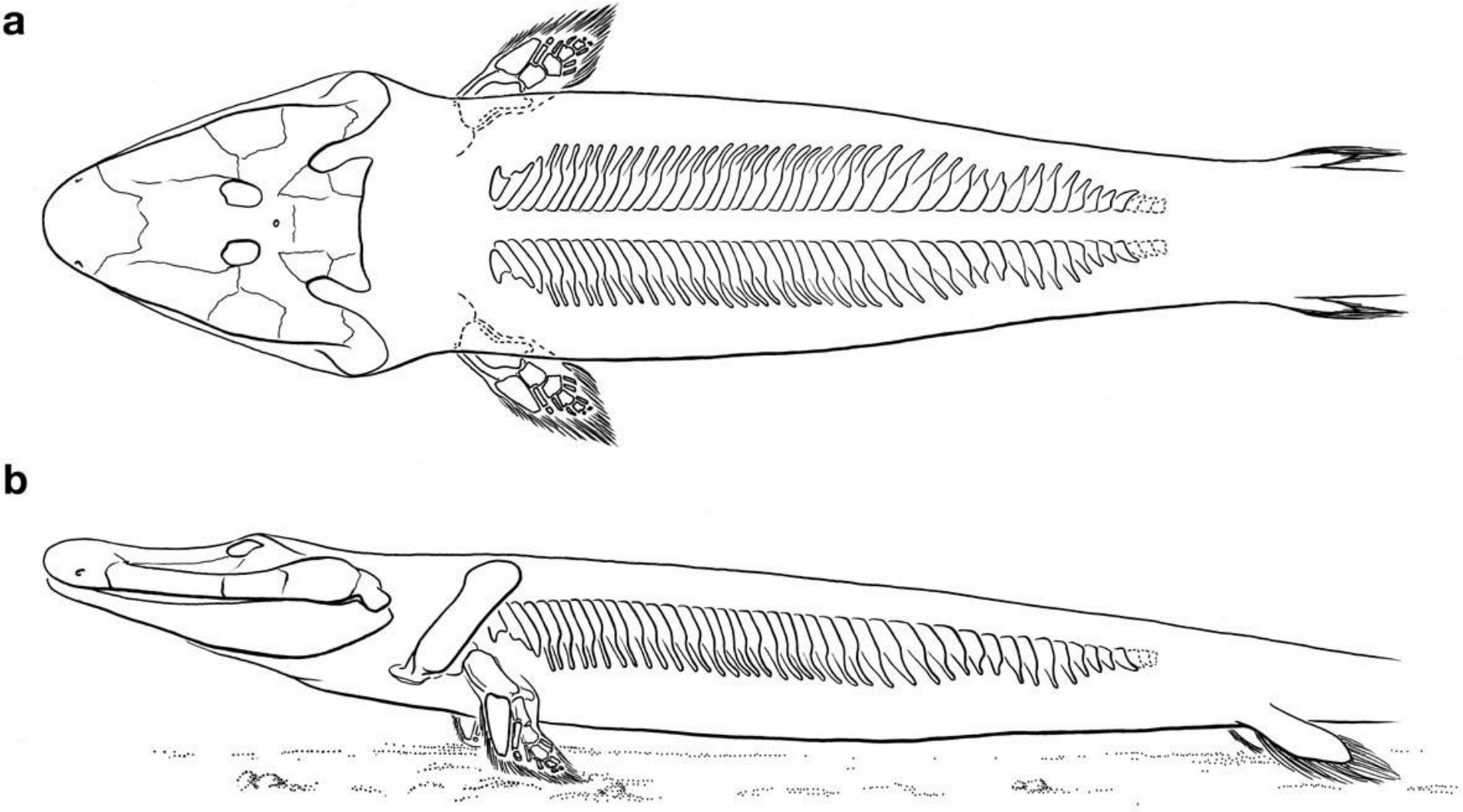


Illustrations by: Kalliopi Monoyios



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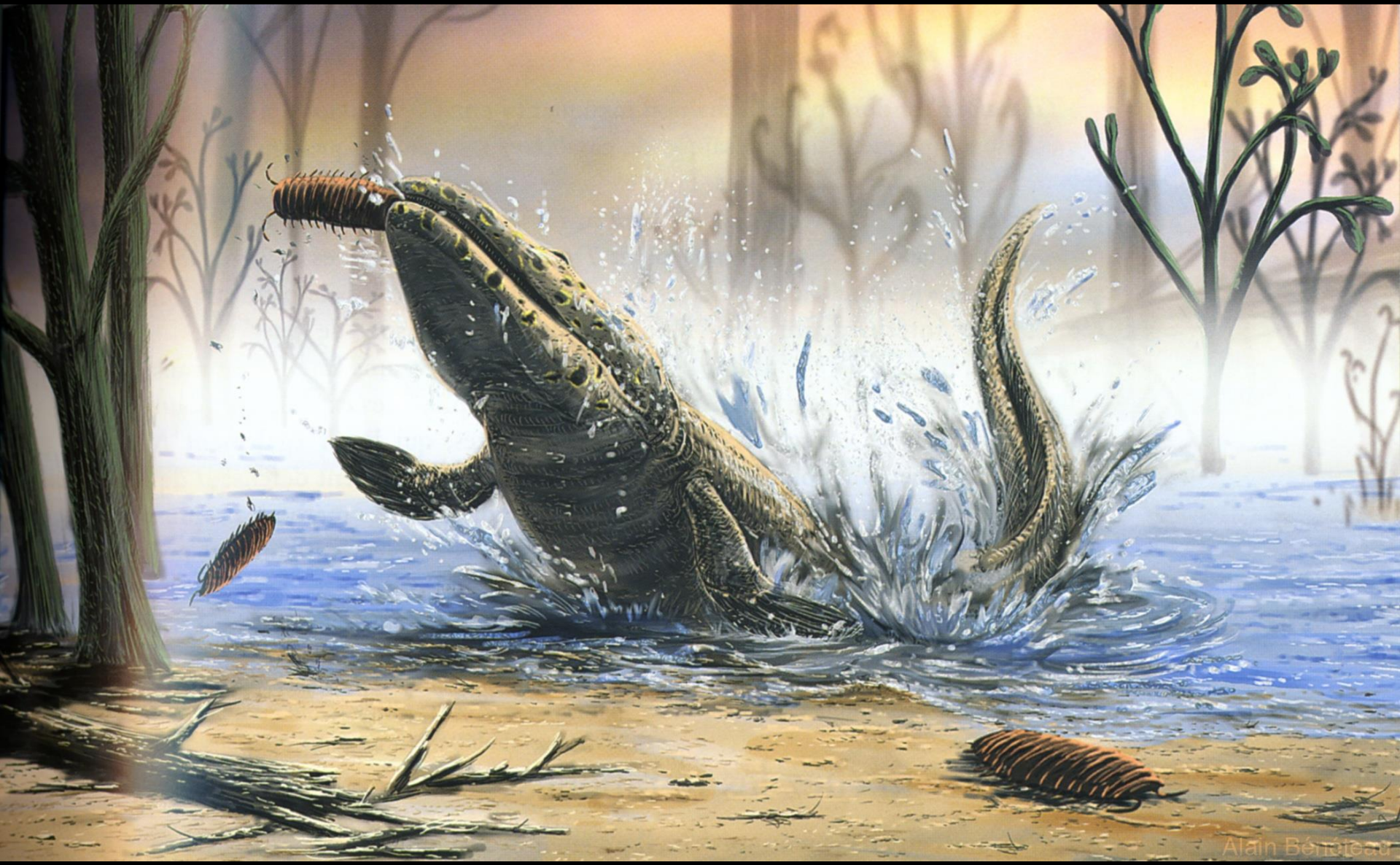

Alain Bénéteau

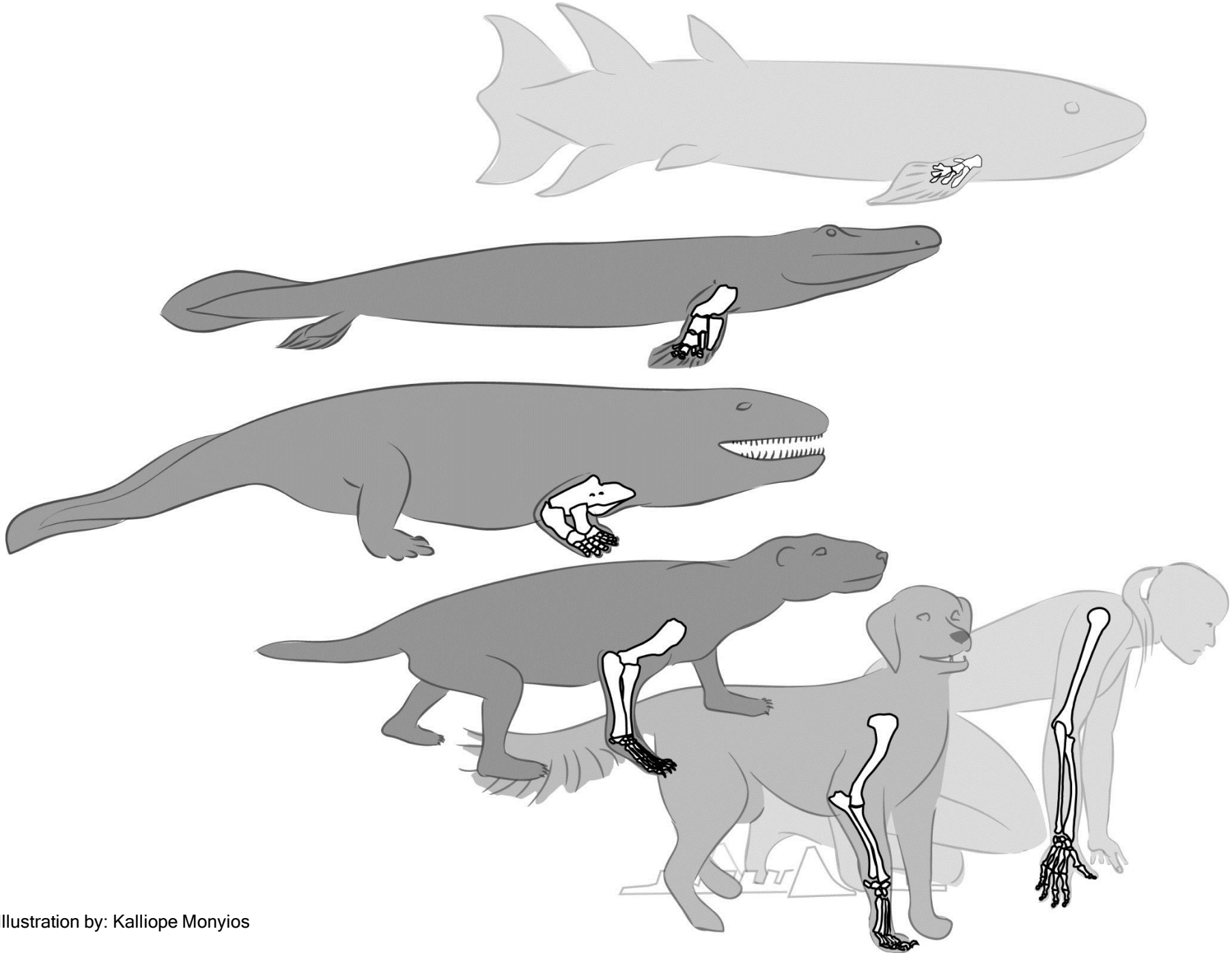
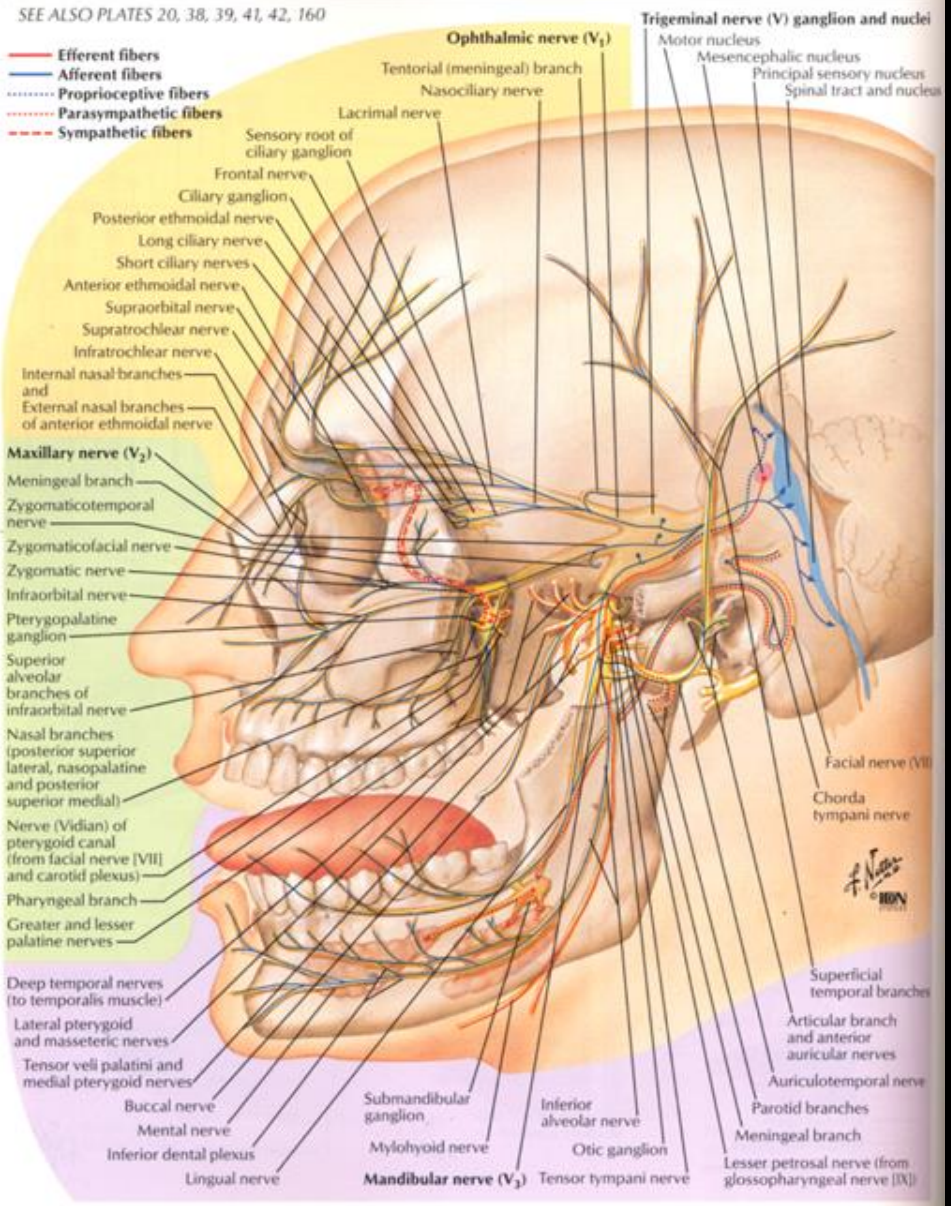


Illustration by: Kalliope Monyios

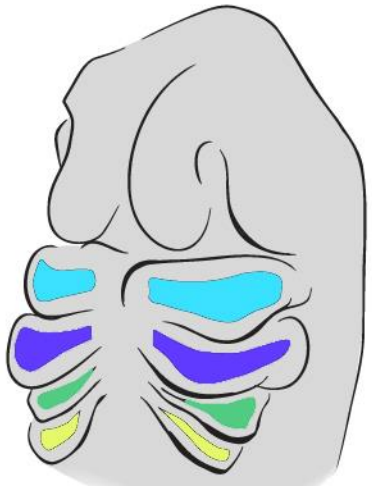
Trigeminal Nerve (V): Schema

SEE ALSO PLATES 20, 38, 39, 41, 42, 160



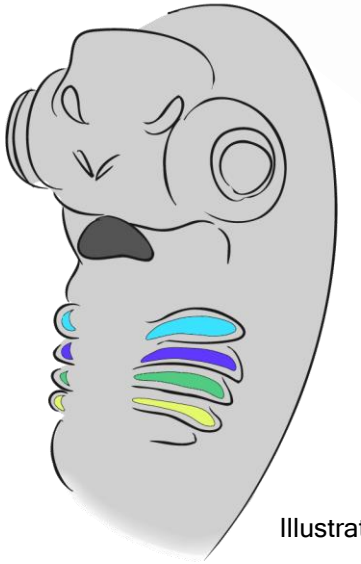
Einstein

Fish

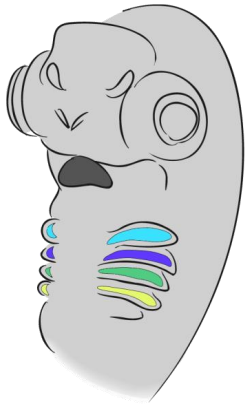


Human Embryo

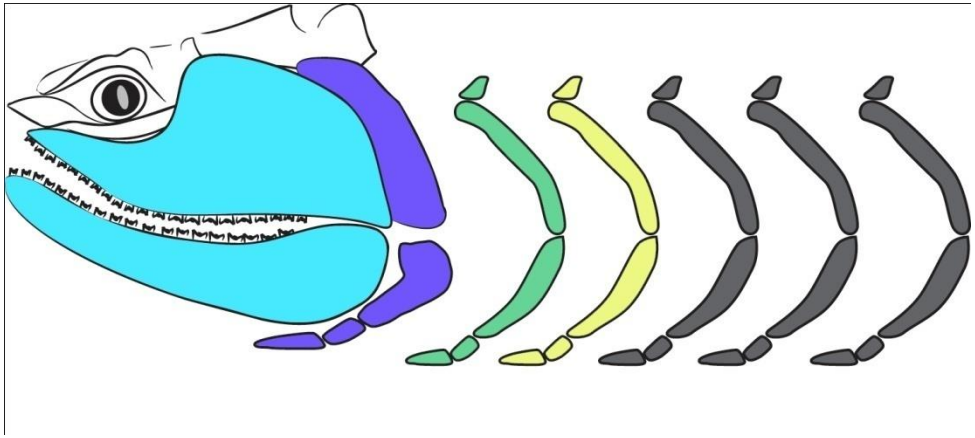
Shark Embryo



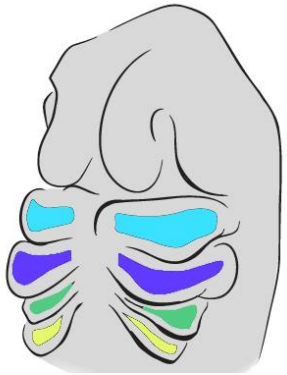
Illustrations by: Kalliopi Monoyios



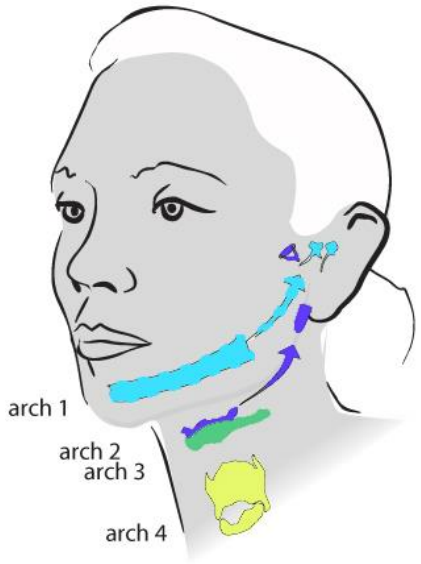
Shark Embryo



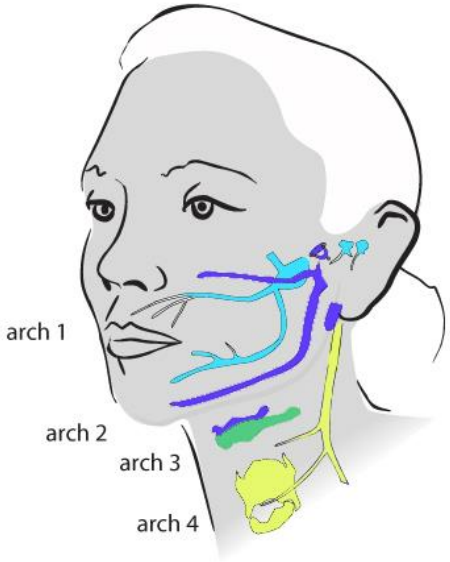
Adult shark



Human Embryo

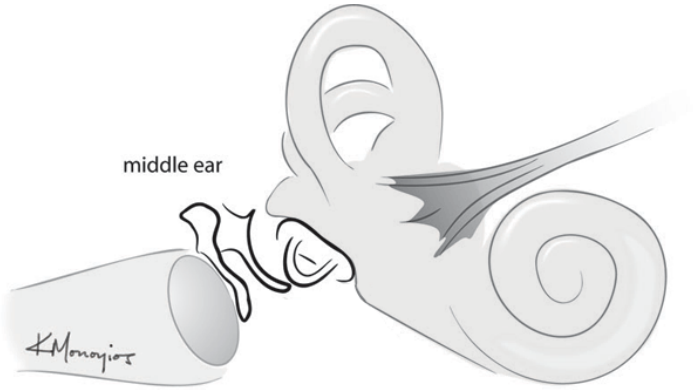


Bones in adult



Arteries in adult

Illustrations by: Kalliopi Monoyios



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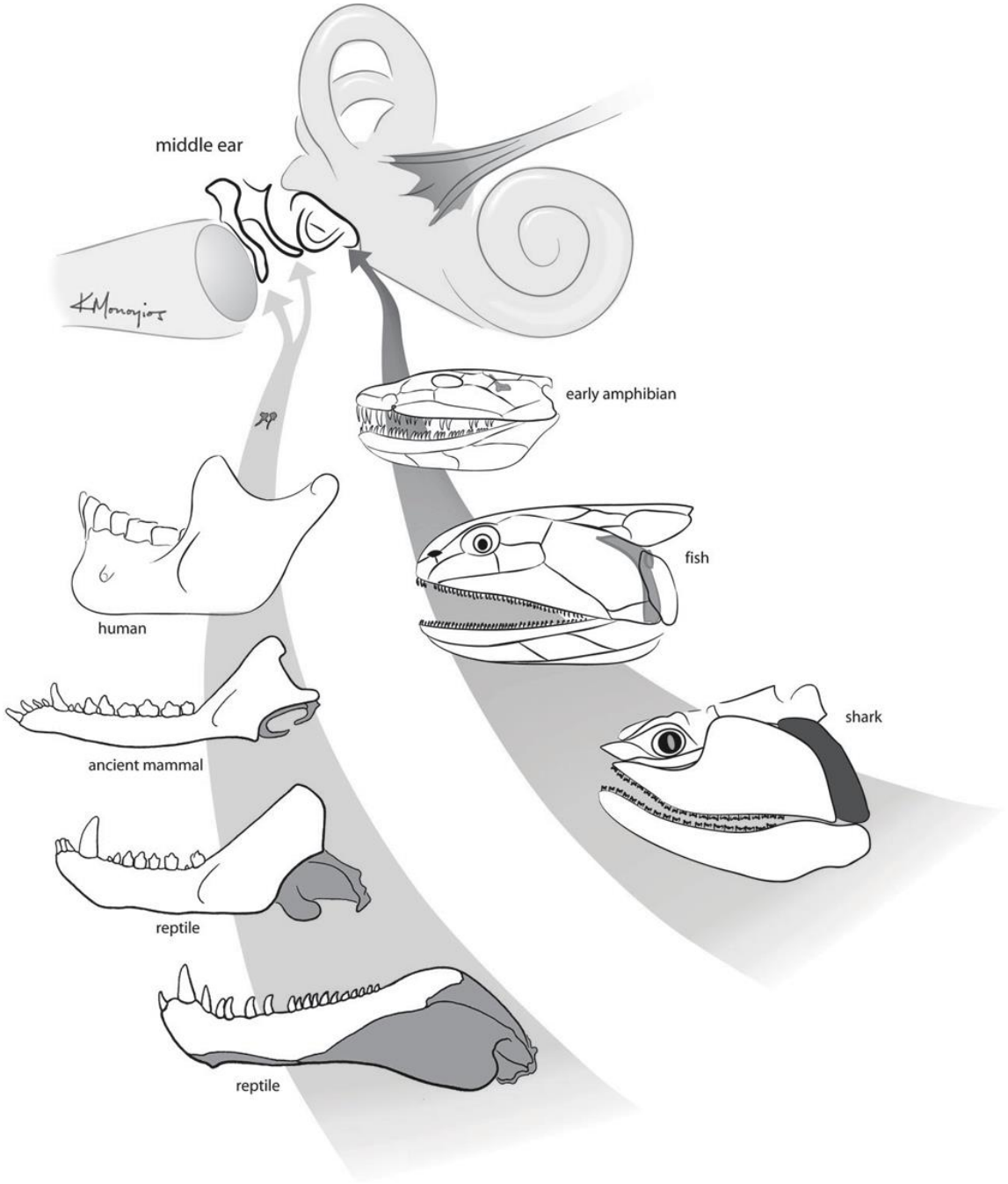
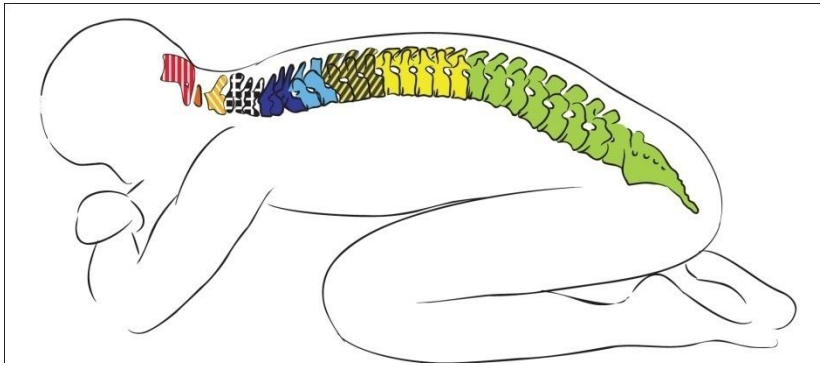


Illustrations by: Kalliopi Monoyios


rnol
CANARY



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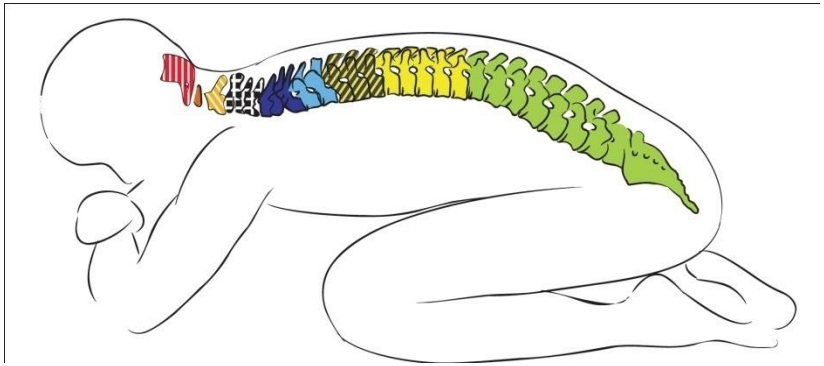

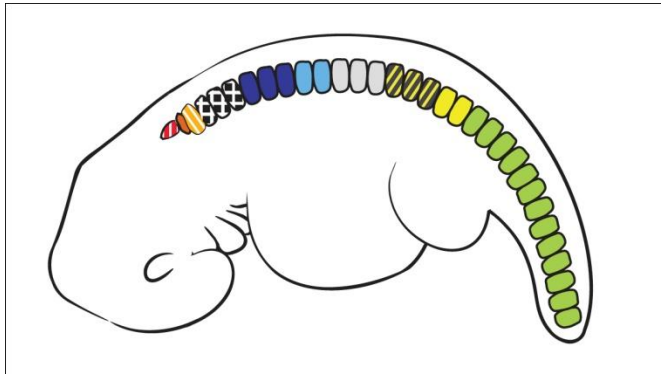

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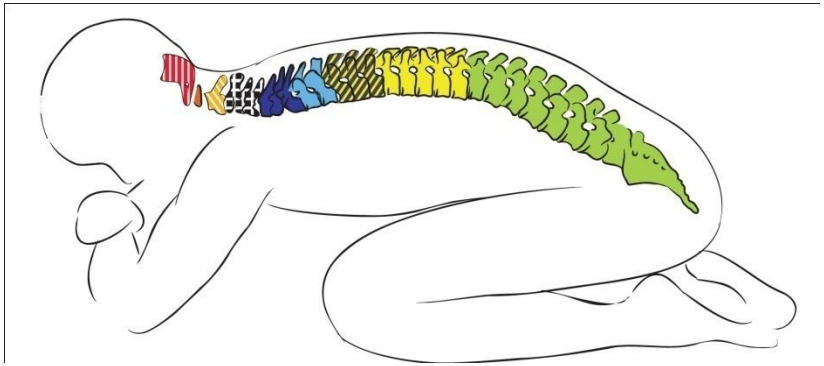

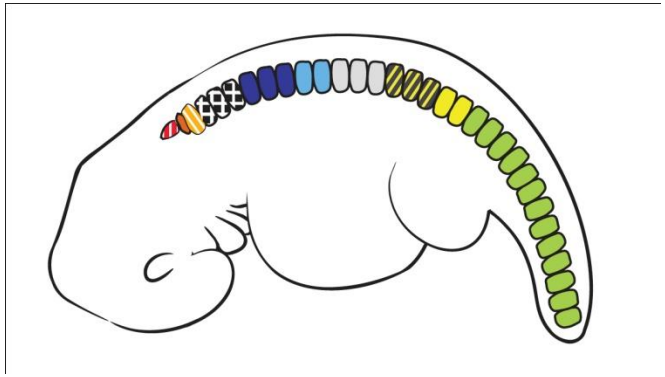

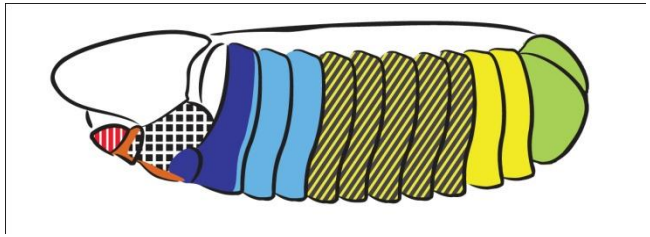

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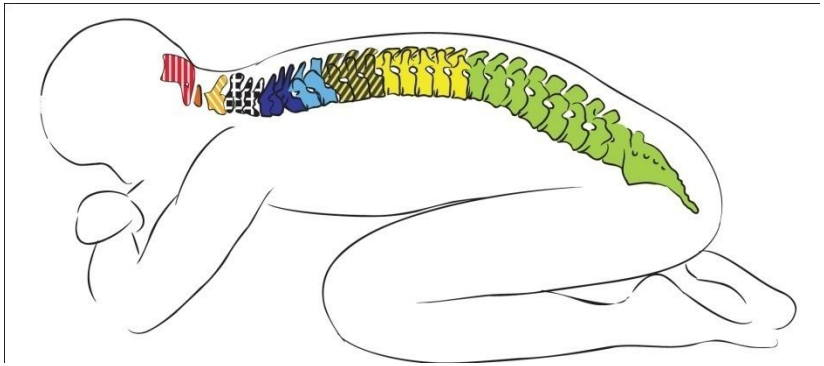

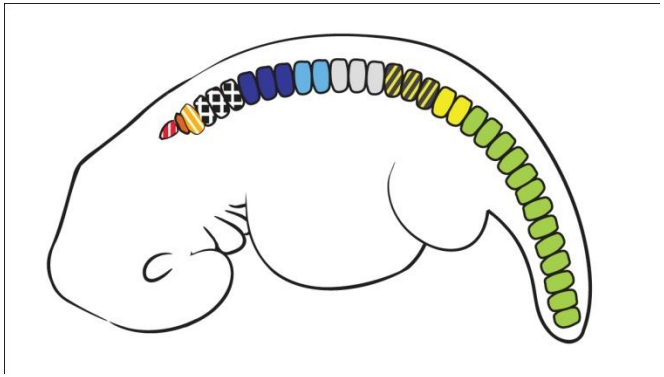

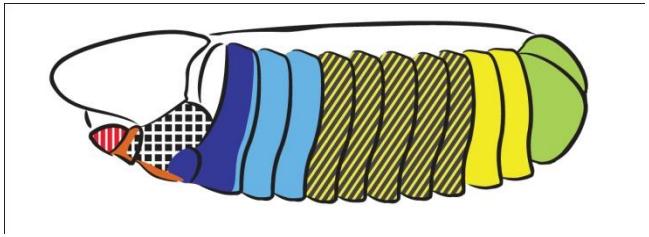

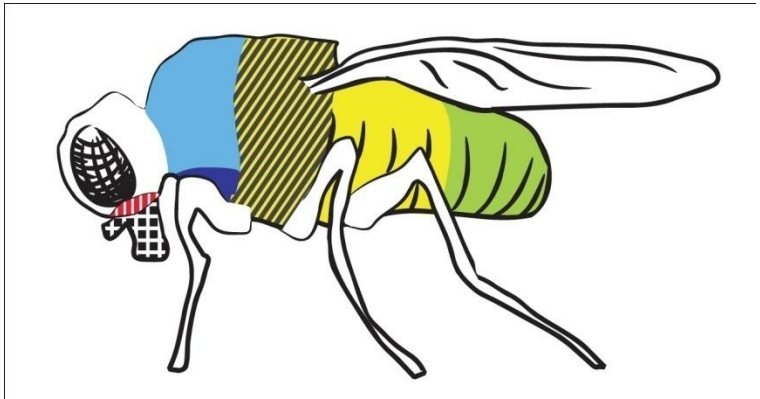

Illustrations by: Kalliopi Monoyios

PLATE 23

Fig. 1. Alternating resistant sandstone units and recessive shale units. Detailed examination revealed that the lithologies are arranged in fining-upward cycles. The sandstone units pictured here are each about 3 m (10 ft) thick. Fram Fm, Bird Fiord area.

Fig. 2. Thin sandstone unit in lower portion of Fram Fm, Bird Fiord area. Note abrupt basal contact and gradational upper contact.

Fig. 3. Trough cross-beds in sandstone unit of Fram Fm, Bird Fiord area. Dave Christie for scale.

Fig. 4. Sandstone channel fill in Fram Fm, Bird Fiord area. Note onlapping of beds. Dave Christie for scale.

PLATE 23

July 1974

July 2004

Dr. Neil Shubin

Neil Shubin is Associate Dean and Robert R. Bensley Professor of Organismal Biology and Anatomy at The University of Chicago. A JohnSimon Guggenheim Memorial Foundation fellow, Shubin earned a Ph.D.in organismic and evolutionary biology from Harvard University in 1987and joined the University faculty as Chairman of Organismal Biology &Anatomy in 2001. Neil Shubin researches the evolutionary origin of anatomical features of animals. He has conducted field work in Greenland, China, Canada, much of North America and Africa, and he has published multiple articles in the Journal of Vertebrate Paleontology and Paleobiology, as well as more than 18 articles in Science and Nature.