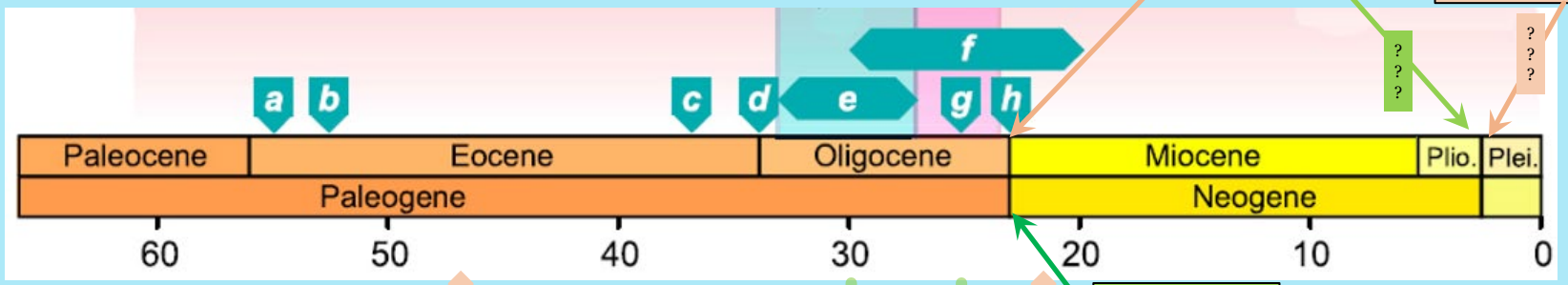
PASSERINES
DIVERSIFY

PASSERINE SPECIATION TIMELINE (SIMPLIFIED)



Four different dispersals of Oscines out of Australia (20-30 Ma)

Common ancestor of Paridae and Remizidae diverges in tropical Africa and China

Paridae colonize New World

???

Baeolophus originates in New World (most other Paridae, originate in Asia)

???

8

8 Passerines began to diversify (47 Ma)

1

Oscines reach Europe (24 Ma), then Asia (23 Ma)

1 Families Paridae & Remizidae diverge (22 Ma)

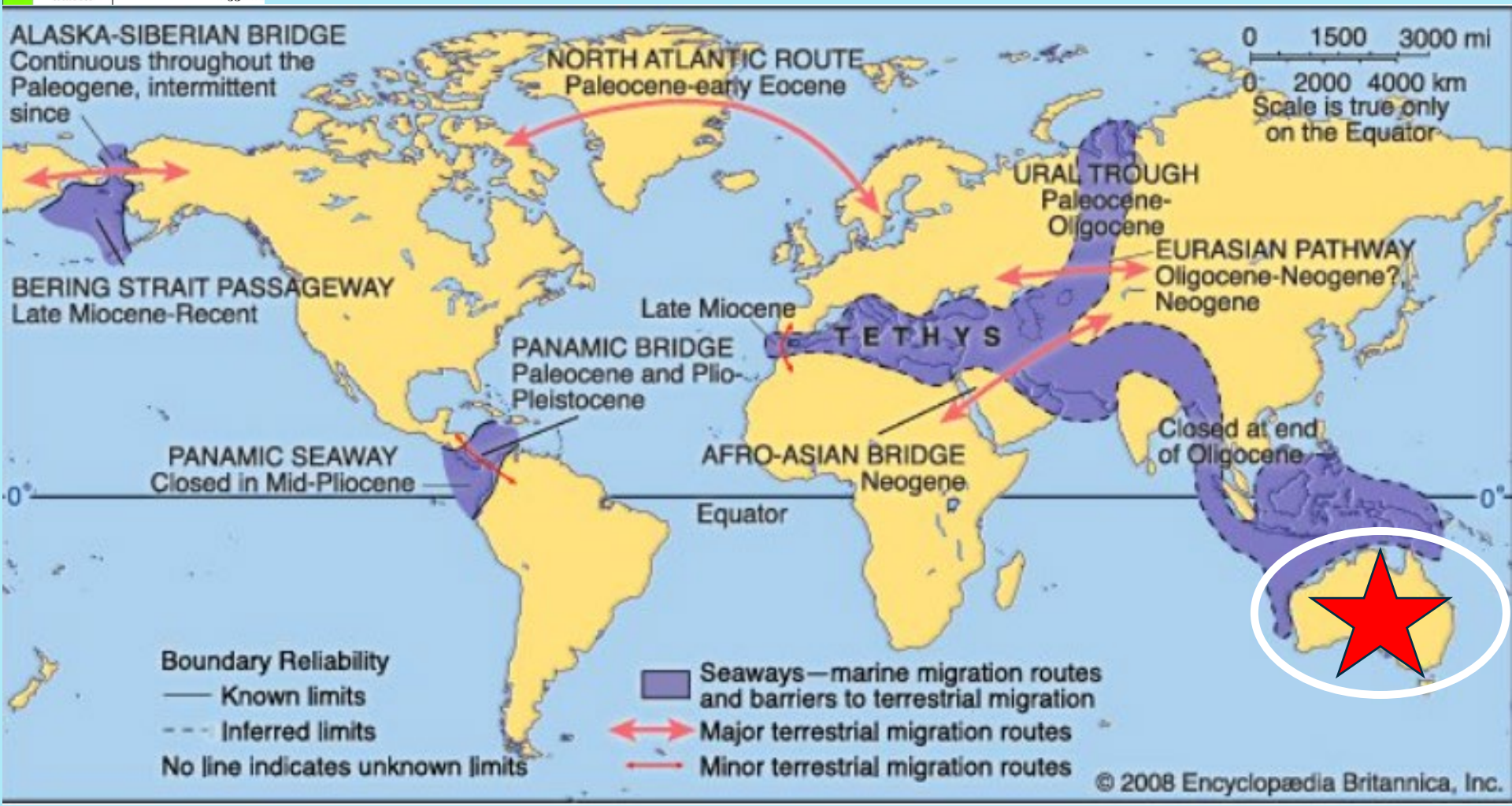
Sylvioidea clades diversify & disperse across the Old World (25-30 Ma)

Divergence

Dispersal

Era	Period	Epoch	Age
Cenozoic	Quaternary	Holocene	0.01 Ma
		Pleistocene	1.8 Ma
	Tertiary	Pliocene	5 Ma
		Miocene	24 Ma
		Oligocene	34 Ma
		Eocene	55 Ma
		Paleocene	65 Ma
Mesozoic	Cretaceous	Late	99 Ma
		Early	144 Ma
	Jurassic	Late	159 Ma
		Middle	180 Ma
		Early	206 Ma
	Triassic		253 Ma

PASSERINES DIVERSIFY IN AUSTRALIA (47 MA)



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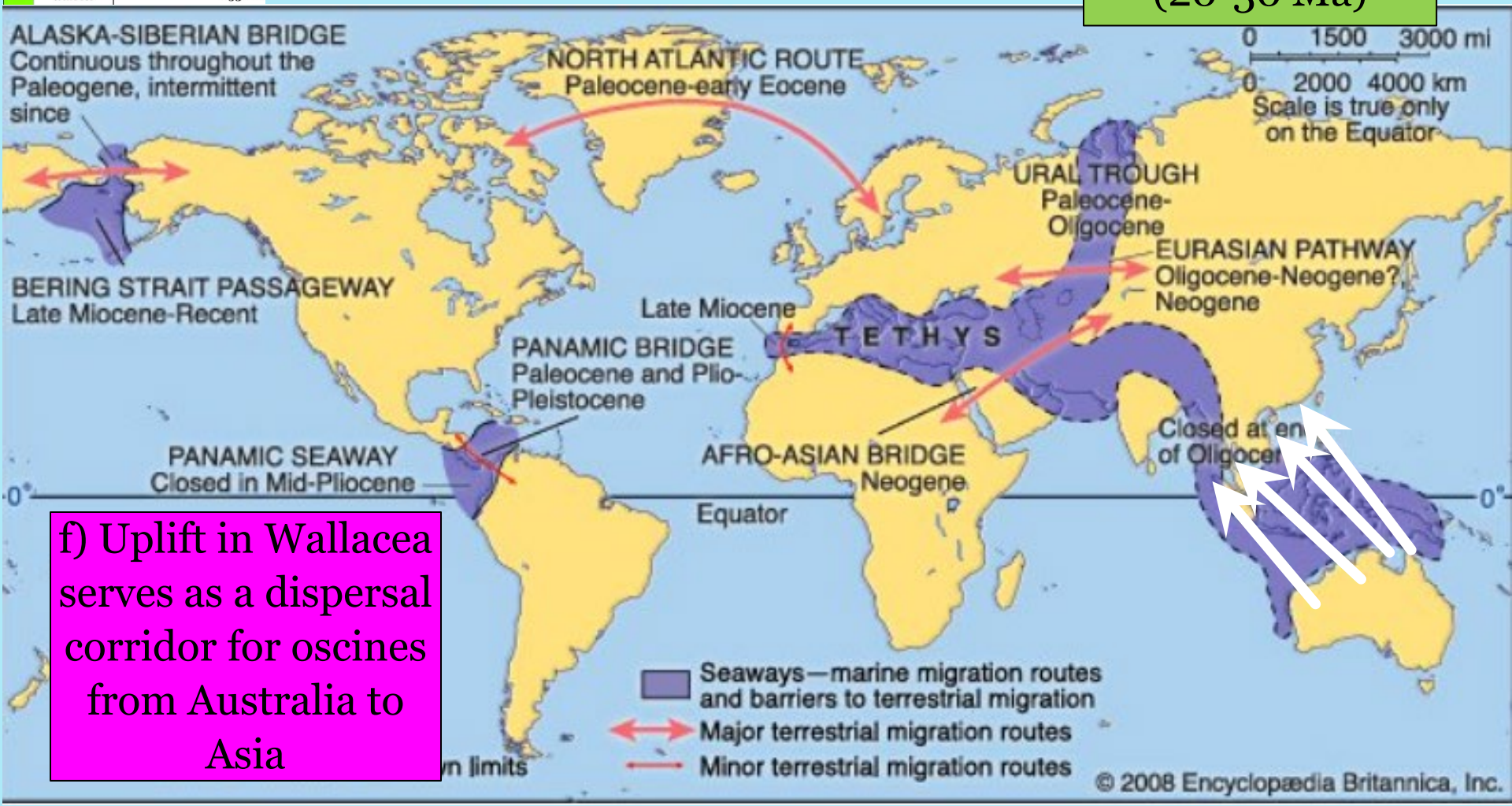
PASSERINES DISPERSE OUT OF AUSTRALIA (20-30 MA)

Four different dispersals of Oscines out of Australia (20-30 Ma)



f) Uplift in Wallacea serves as a dispersal corridor for oscines from Australia to Asia

Era	Period	Epoch	Age
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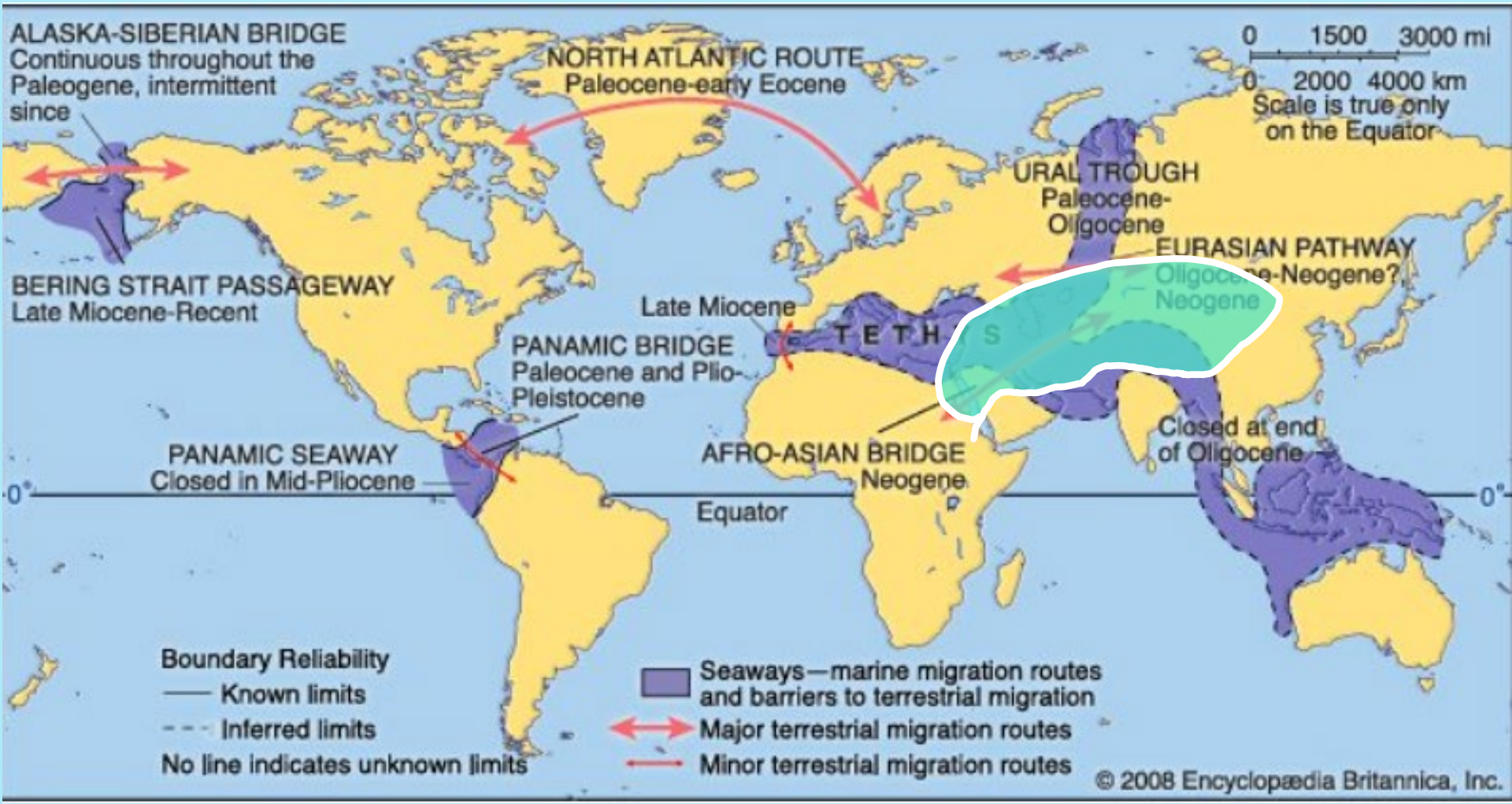
SYLVIIDA PARV-ORDER DIVERSIFIES & DISPERSES ACROSS THE OLD WORLD (25-30 MA)



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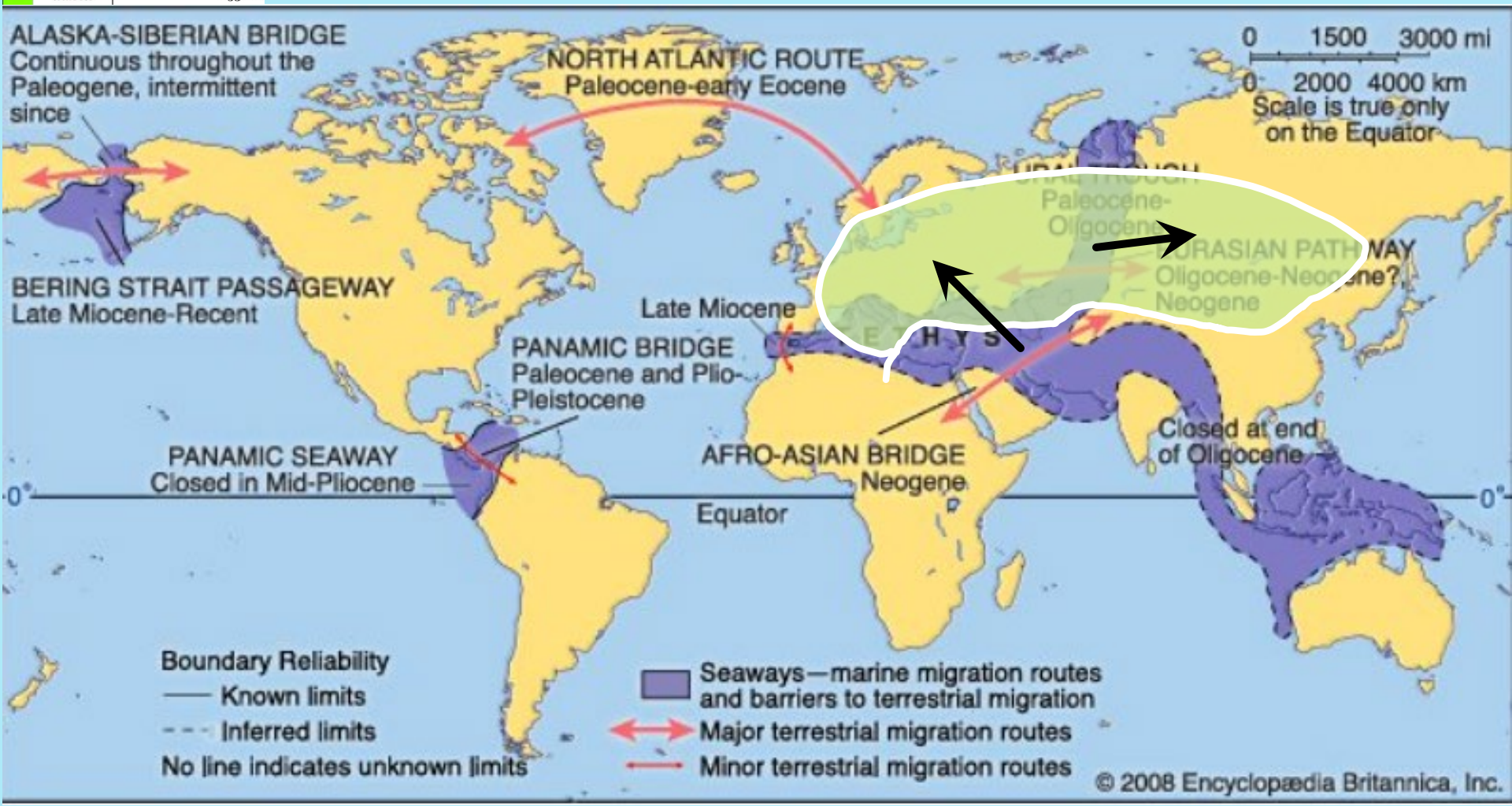
	Triassic		253 Ma

OSCINES REACH EUROPE (24 MA), THEN ASIA (23 MA) AND THE AMERICAS



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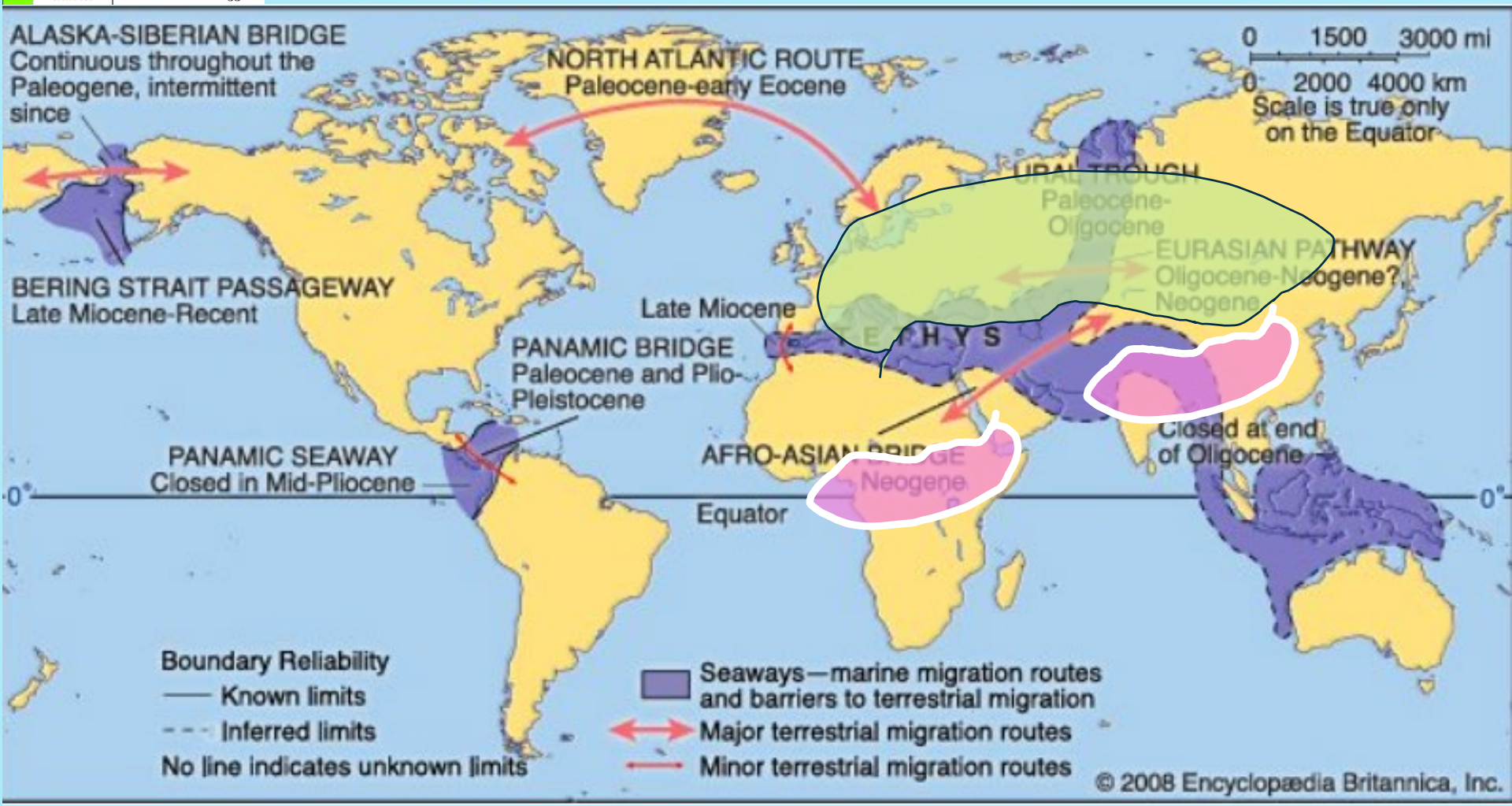
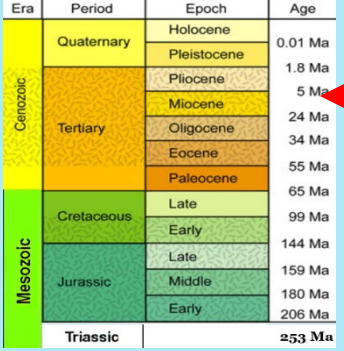
COMMON ANCESTOR OF PARIDAE AND REMIZIDAE DIVERGES IN TROPICAL AFRICA AND CHINA



SPECIATION
IN THE NEW WORLD
(EXAMPLE)



FACTORS THAT MAY HAVE AFFECTED SPECIATION IN THE NEW WORLD: **ECOLOGICAL INTERACTIONS**

- May have influenced Oscine proliferation
- Suboscines arrive in Americas (before Oscines)
- Insectivorous Oscines arrive (Miocene)
- Many ecological niches are occupied
- Later insectivorous Oscines arrive (competition)
- Some Oscines shift from insects to fruit
- Less competition from insectivorous Suboscines & Oscines
- Very successful group
- Most New World Oscines are frugivorous today
- May be key to extreme diversity of Oscines

Era	Period	Epoch	Age
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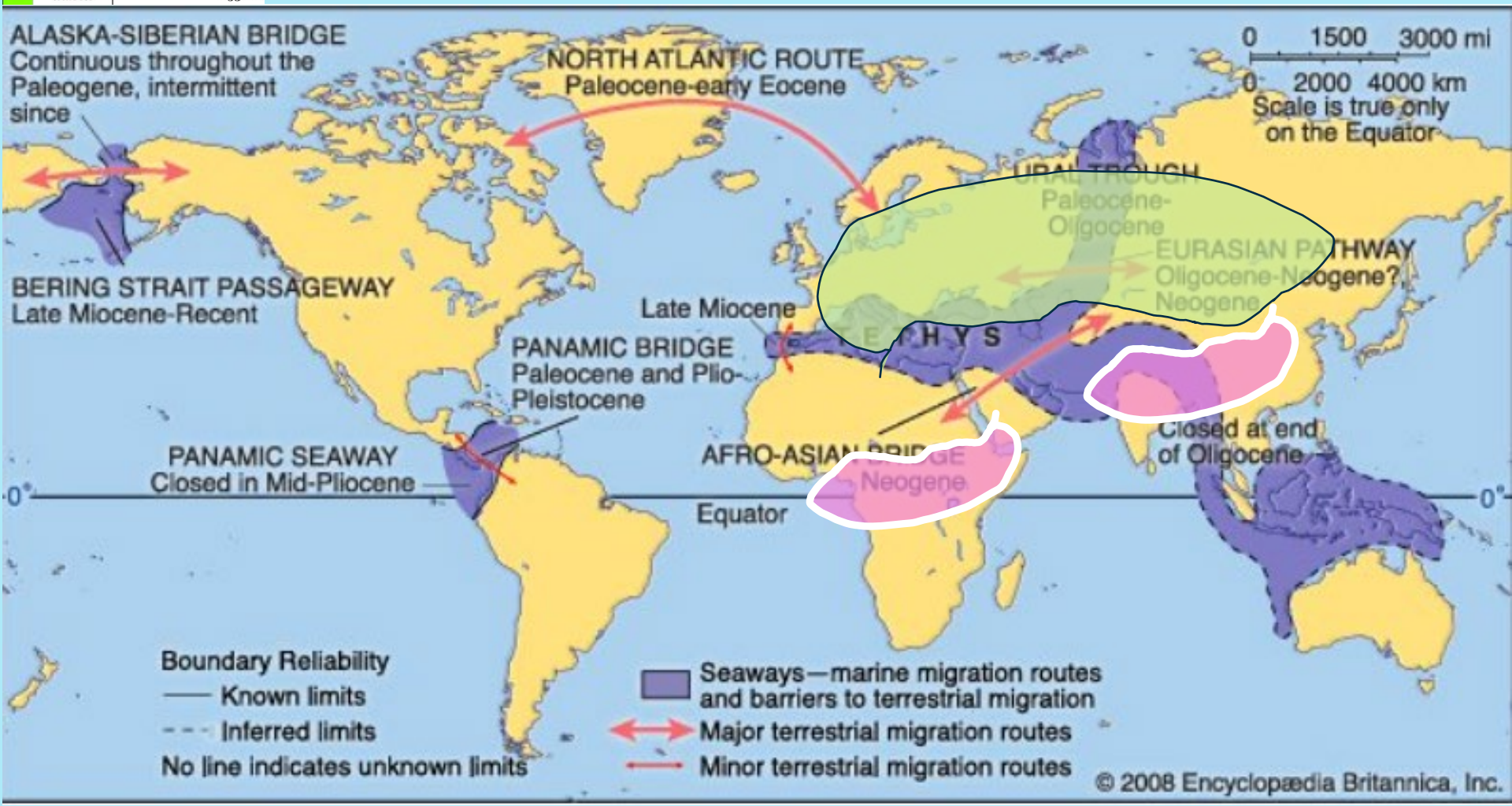
FAMILIES PARIDAE AND REMIZIDAE DIVERGE



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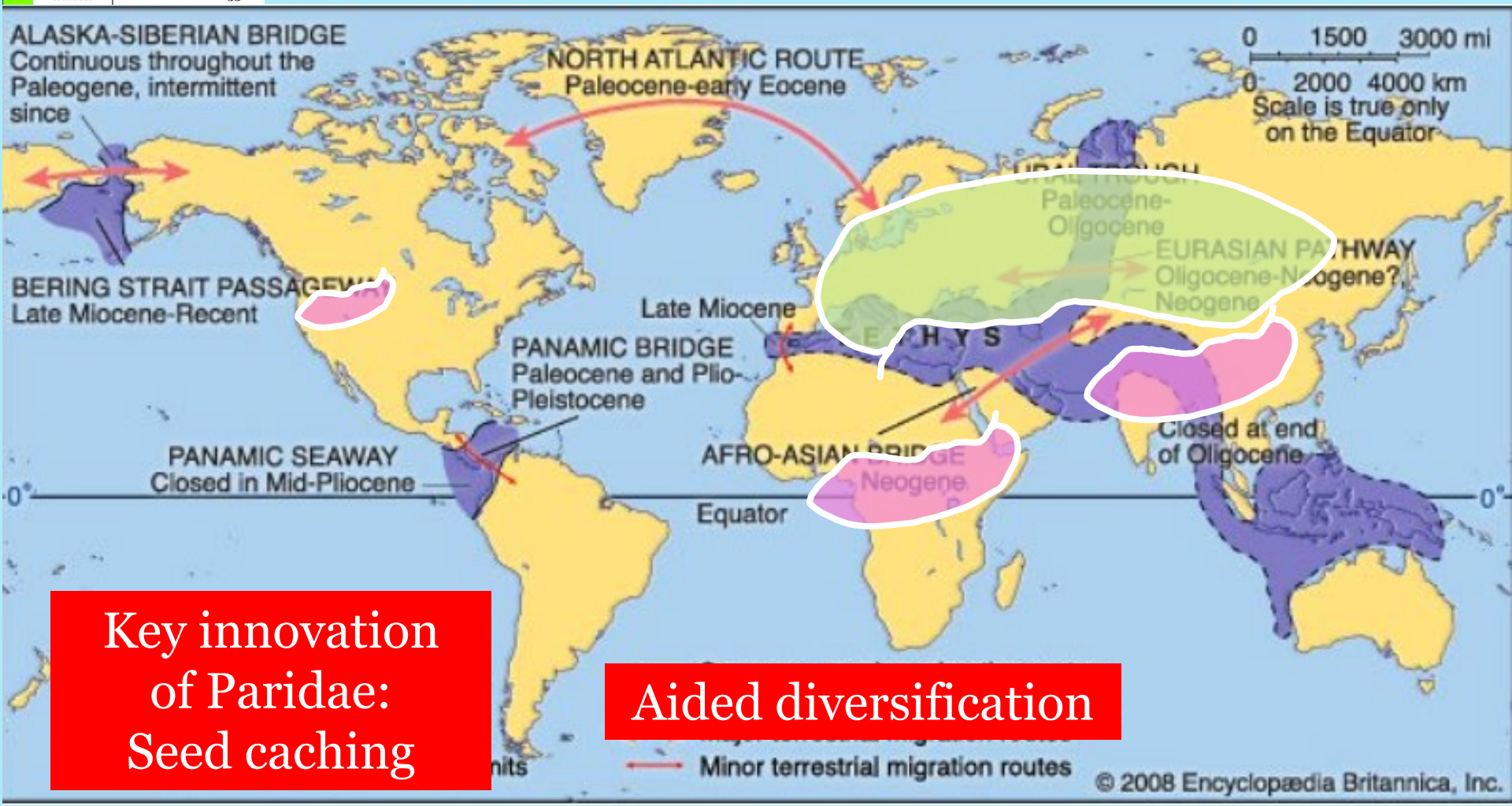
FAMILY PARIDAE DIVERSIFIES AROUND THE WORLD & COLONIZES NORTH AMERICA (PLIOCENE)

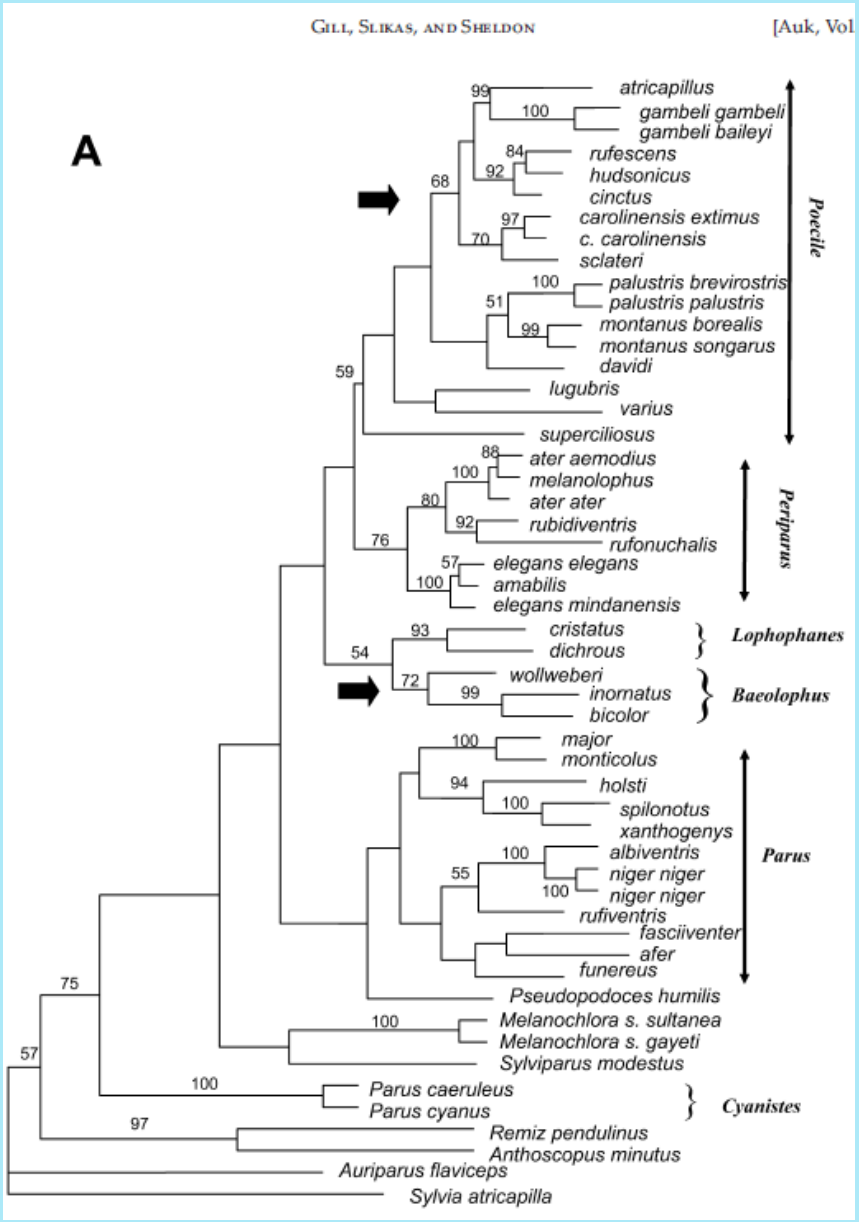


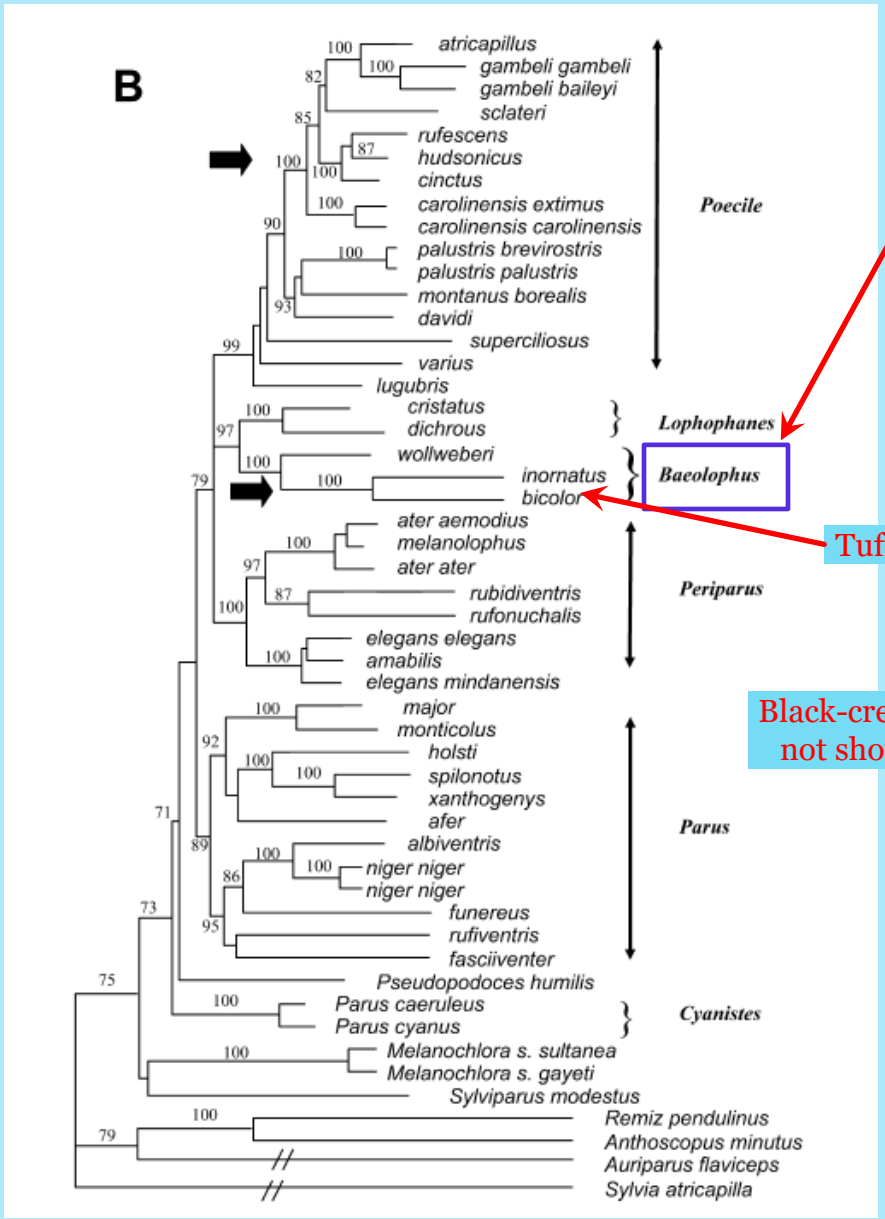
Key innovation of Paridae: Seed caching

Aided diversification

FAMILY PARIDAE DIVERSIFY AROUND THE WORLD

(GILL, SILKAS AND SHELDON)





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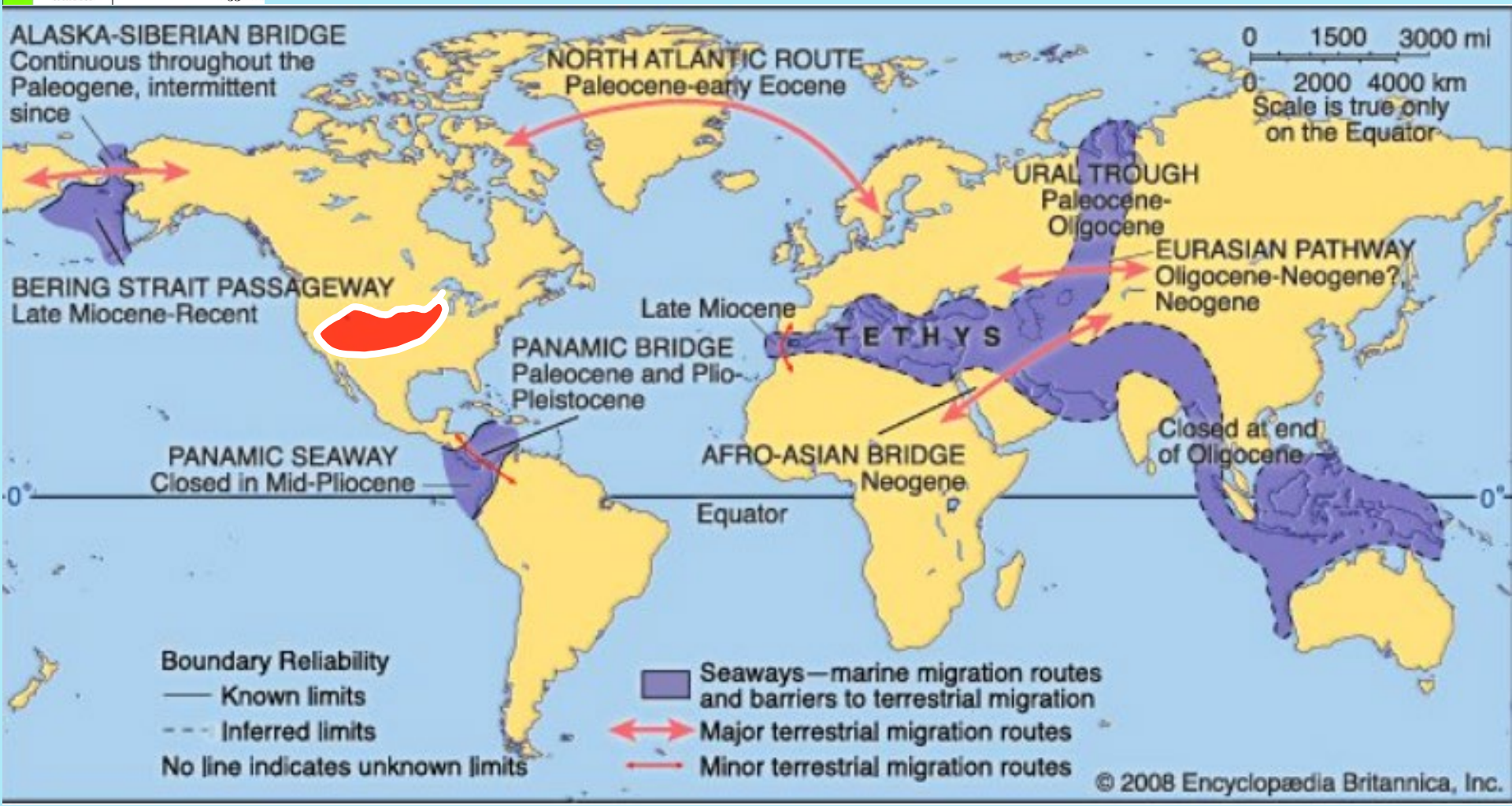
GENUS BAEOLOPHUS ORIGINATES IN NEW WORLD (PLIOCENE)

(MOST OTHER PARIDAE, ORIGINATE IN ASIA)



Pliocene
~5.3 M to
~1.6M years ago

Era	Period	Epoch	Age
Cenozoic	Quaternary	Holocene	0.01 Ma
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Geological Time Scale

ERA	PERIOD	EPOCH / AGE	Million Years Ago	EVENTS
CENOZOIC *Age of Mammals* 65.5 mya – present day	*Quaternary*	*Holocene*	*Today*	Ice Age ends Humans are dominant
		Pleistocene	*0.01*	Earliest Humans appear Ice Age begins
	Tertiary	*Pliocene*	*1.6*	Hominids (human ancestors) appear
		Miocene	*5.3*	Grass becomes widespread
		Oligocene	*23.7*	Mammals are dominant
		Eocene	*36.6*	Eocene – Oligocene extinction event
		Paleocene	*57.8*	First large mammals appear
MESOZOIC *Age of Reptiles* 245 mya – 65.5 mya	*Cretaceous*	*Extinction of Dinosaurs*	*65.5*	K-T extinction event Earth looks closer to present-day Flowering plants appear
	Jurassic		*144*	First Birds appear Pangaea splits into Laurasia, Gondwanna Dinosaurs are dominant
	Triassic	*First Dinosaurs*	*208*	Pangaea cracks First mammals appear Reptiles are dominant
PALEOZOIC 570 mya – 245 mya	*Permian*	*Age of Amphibians*	*245*	Permian – Triassic extinction event Pangaea forms
	Carboniferous		*286*	First reptiles appear First large cartilaginous fishes appear
	Devonian	*Age of Fishes*	*360*	Late Devonian extinction event First land animals appear First amphibians appear
	Silurian		*408*	First land plants appear First jawed fishes appear First insects appear
	Ordovician	*Age of Invertebrates*	*438*	Ordovician – Silurian extinction event First vertebrates appear
	Cambrian		*505*	End Botomian extinction event First fungi appear Trilobites are dominant
PRECAMBRIAN 4600 mya – 570 mya	*Proterozoic Eon*		*570*	First soft-bodied animals appear First multicellular life appear
	Achean Eon		*2500*	Photosynthesizing cyanobacteria appear First unicellular life appear
	Hadean Eon	*Priscoan Period*	*3800*	Atmosphere and oceans form Oldest rocks form as Earth cools
Formation of Earth			*4600*	

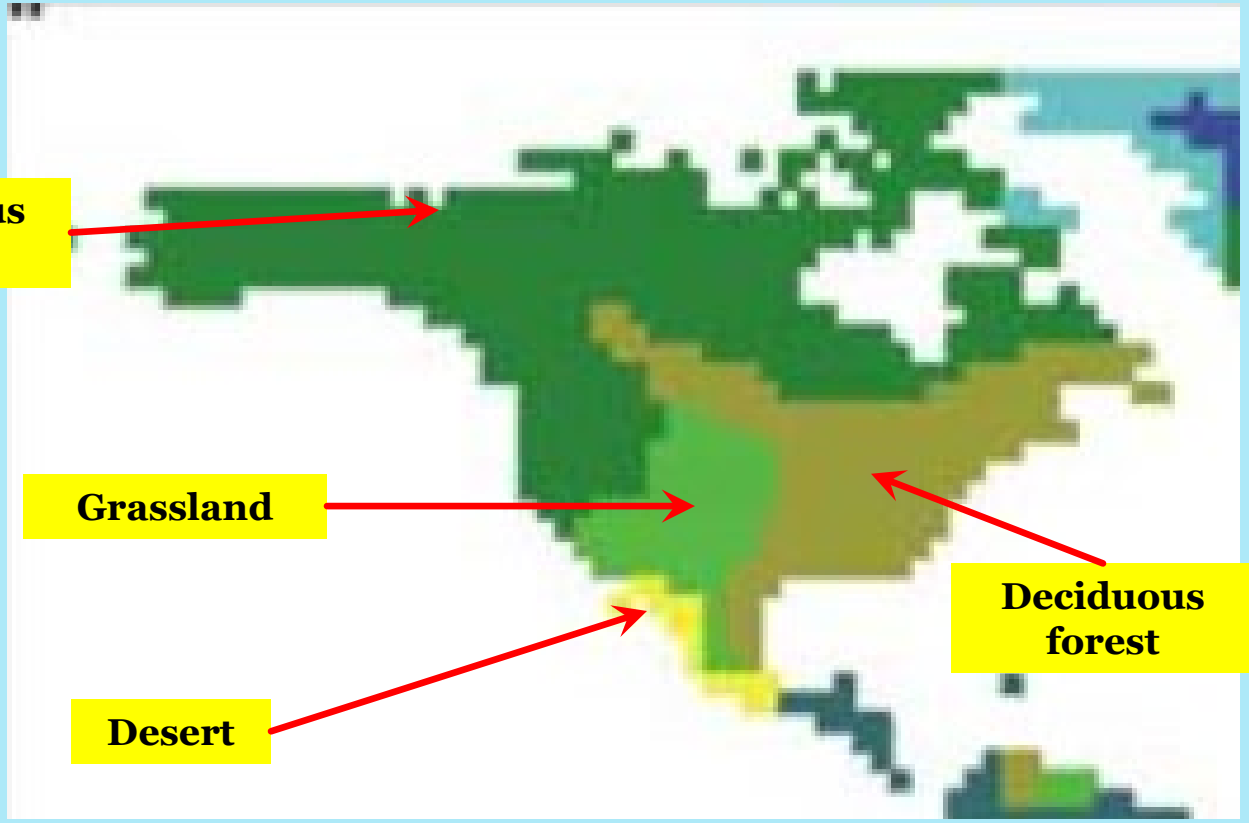
TIME

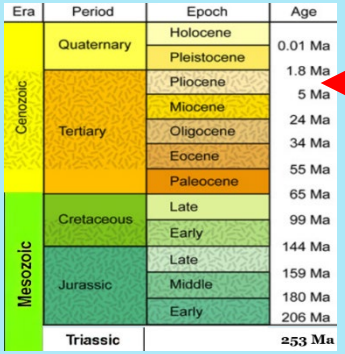
North America in the Pliocene = Warmer, Wetter

Baeolophus

in the Pliocene

~5.3 M to ~1.6M years ago





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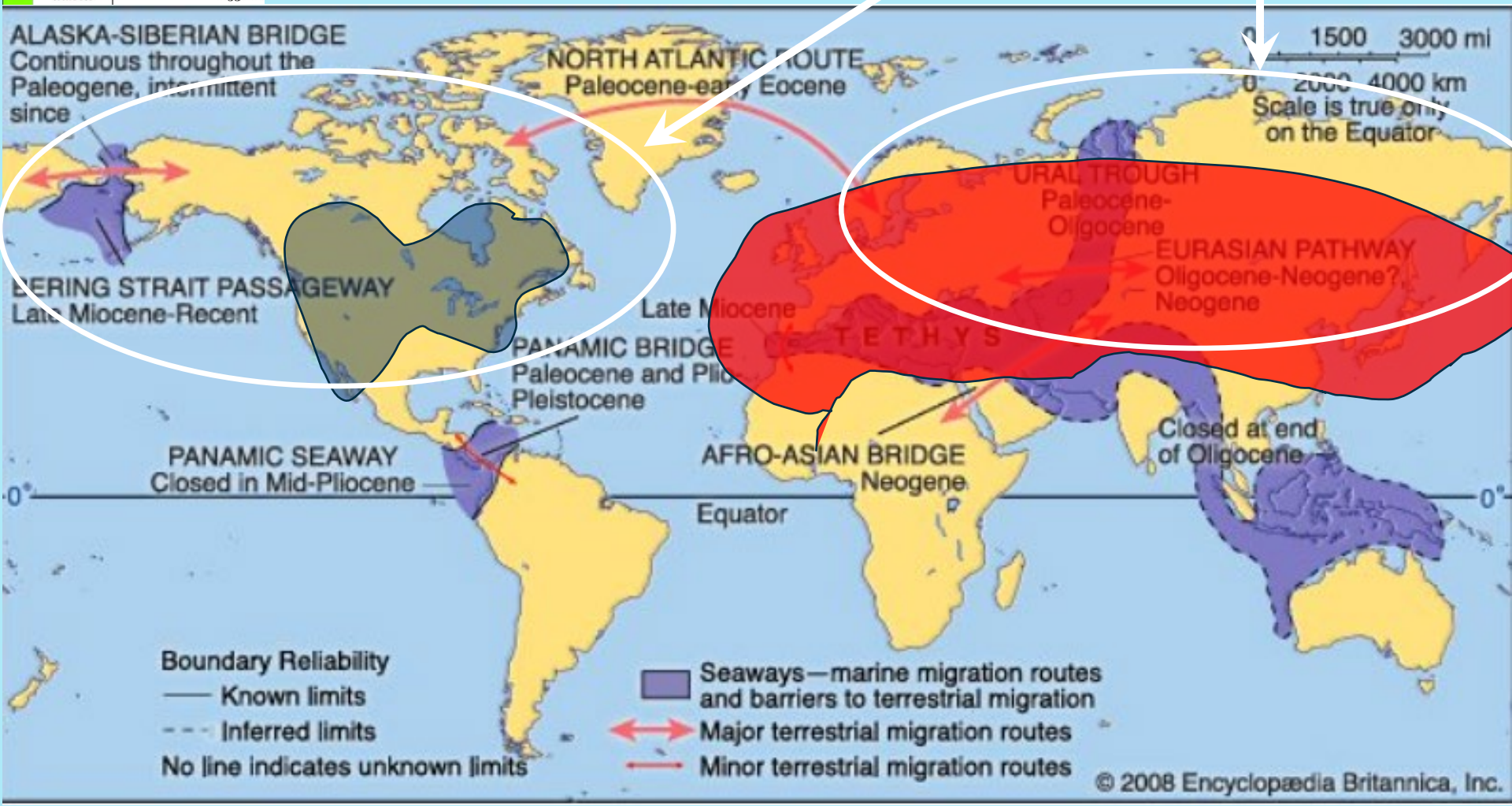
BAEOLOPHUS & OTHER PARIDAE EXPAND & DIVERSIFY THROUGHOUT NEAR-ARCTIC & PALEARCTIC



Pleistocene
~1.6 M to
~10,000 years ago

(ice age, hominids evolved & proliferated)

Geological Time Scale

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	Hadean Eon	*Priscoan Period*	*4600*	Atmosphere and oceans form Oldest rocks form as Earth cools
Formation of Earth				

TIME

PLEISTOCENE THINGS CHANGE

Pleistocene
~1.6 M to
~10,000 years ago

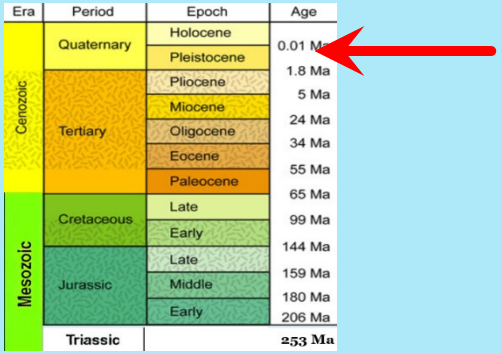
Maximum Extent of Ice Sheets

Ice Sheets come & go (5 times)

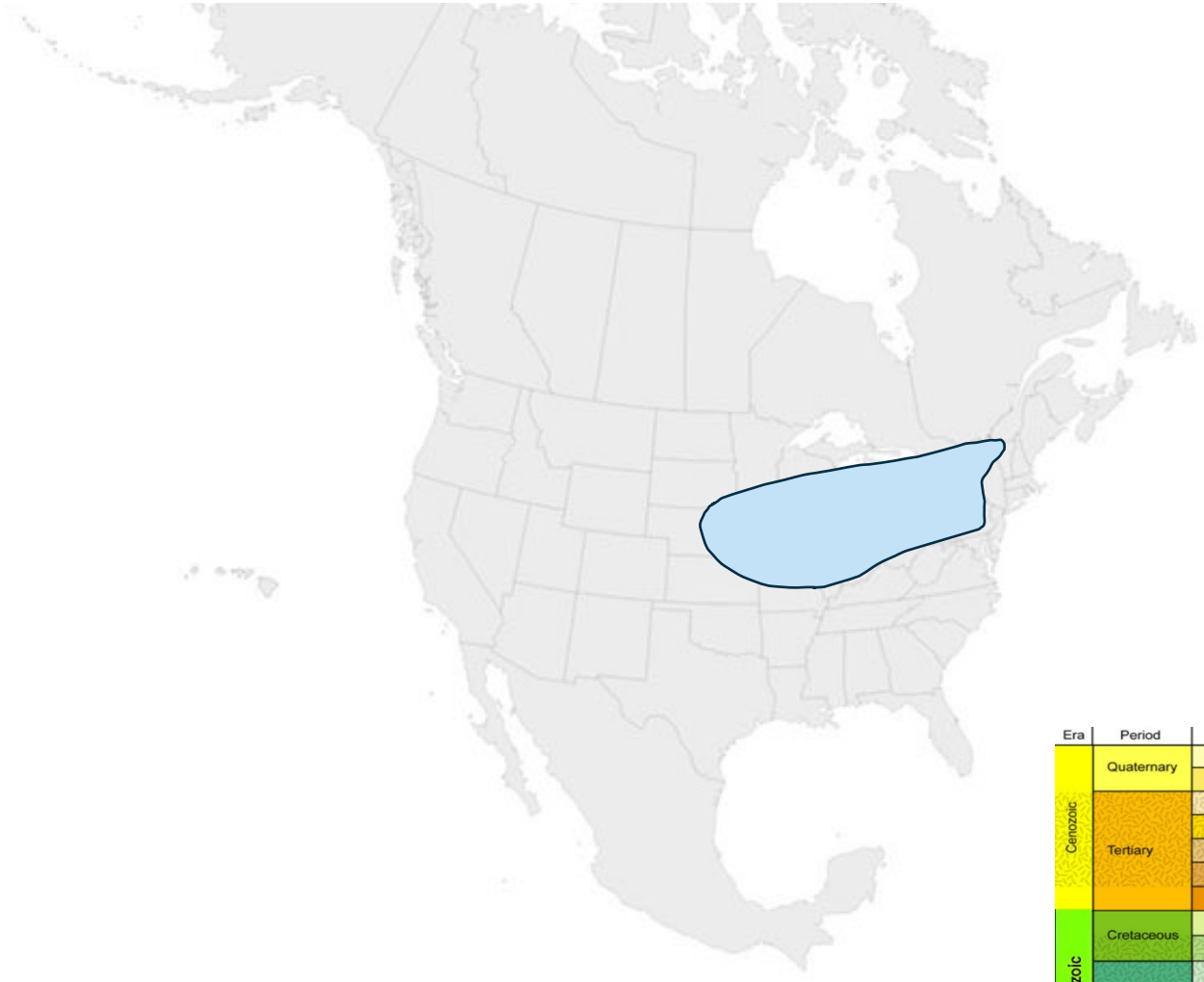
Altering sea levels & rainfall patterns

Habitats fragment worldwide

Hominids evolve & proliferate



BAEOLOPHUS RANGE EXPANDS (PLEISTOCENE)



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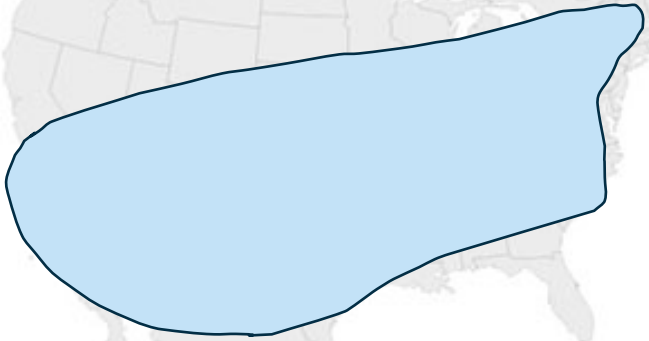
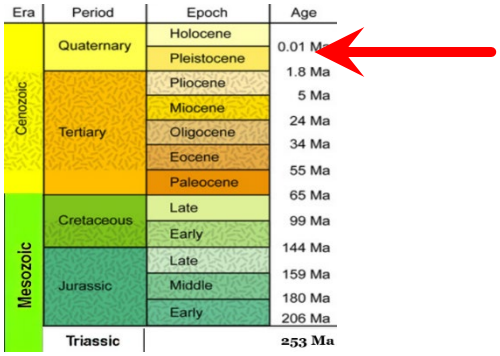
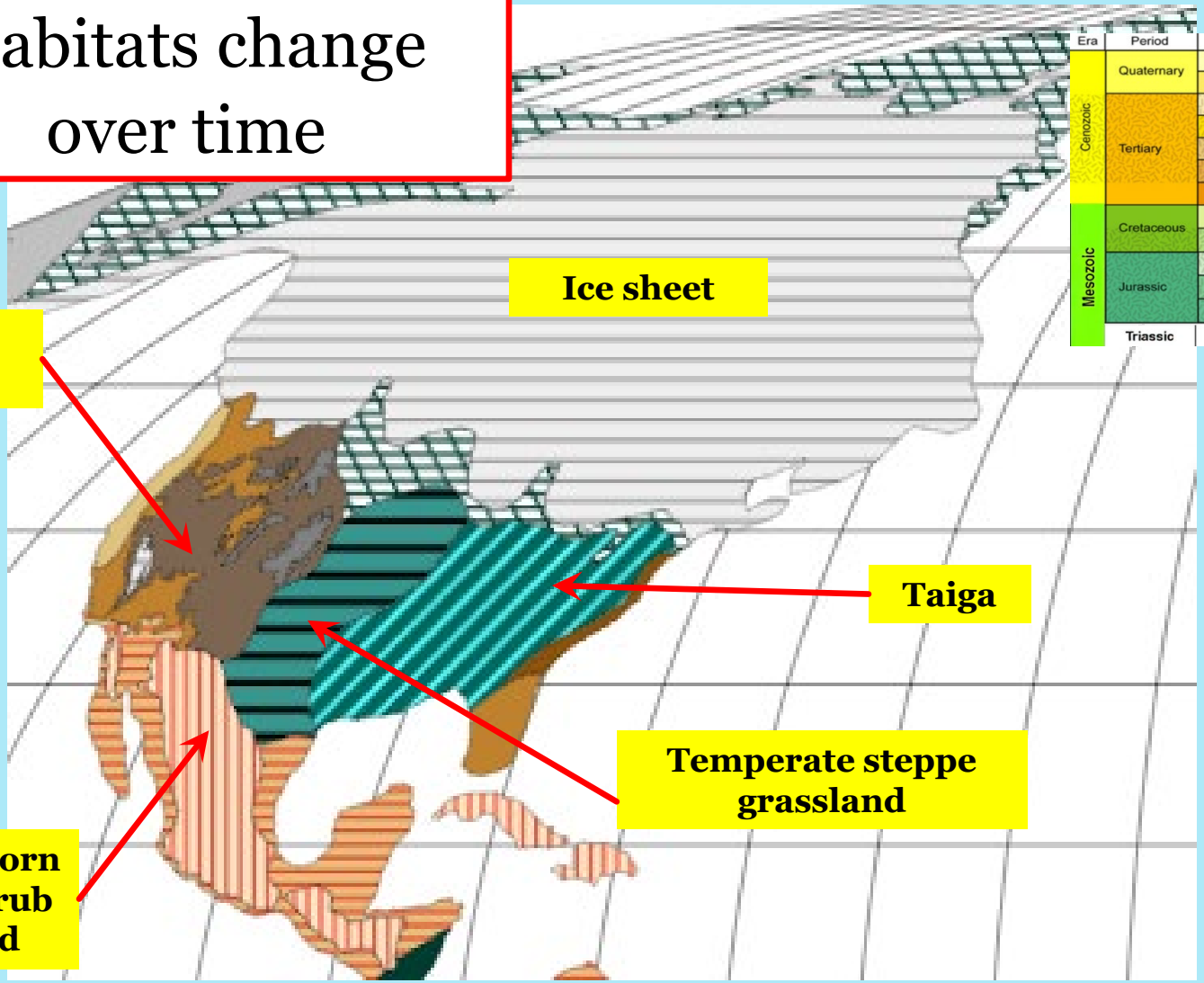




Habitats change over time



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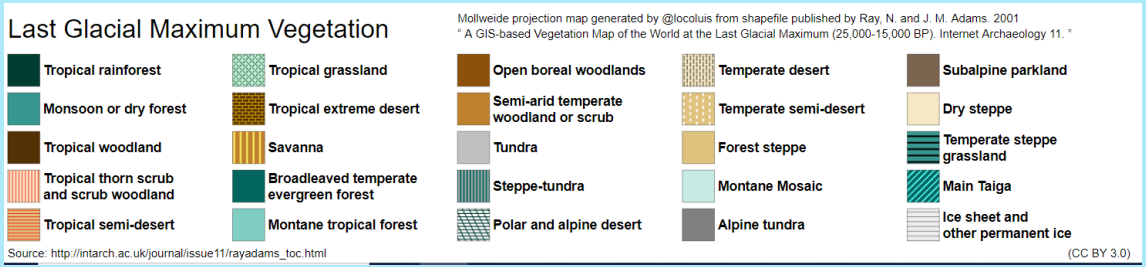
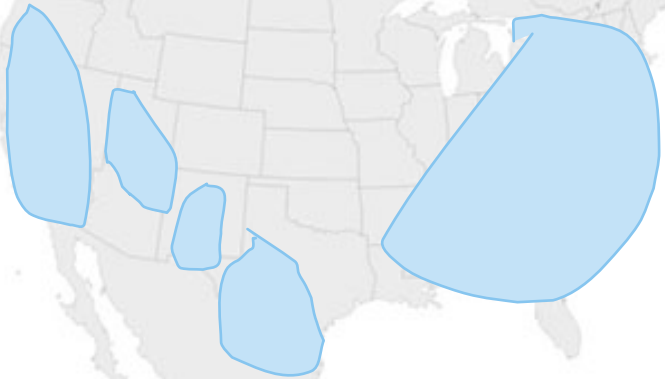
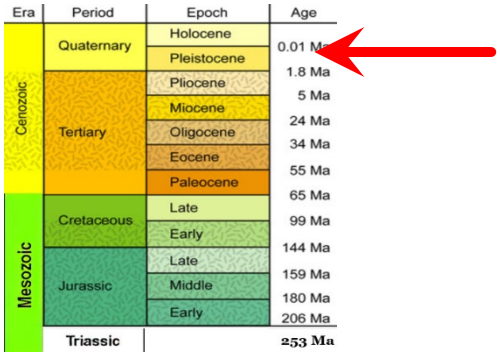


Tiaga – the sometimes swampy coniferous forest of high northern latitudes.

BAEOLOPHUS POPULATIONS BECOME **GENETICALLY** ISOLATED (PLEISTOCENE)

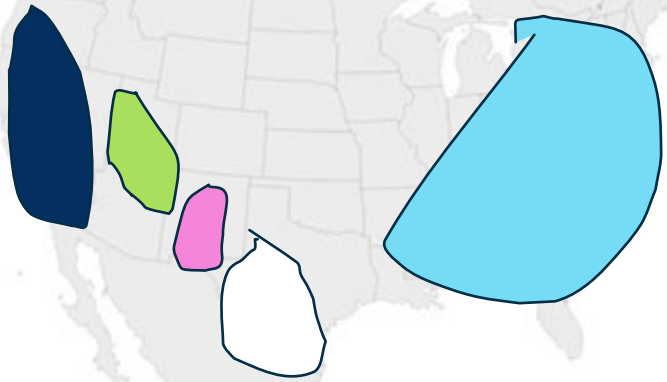
Genetic Isolation occurs





BAEOLOPHUS DIVERSIFIES

(PLEISTOCENE)



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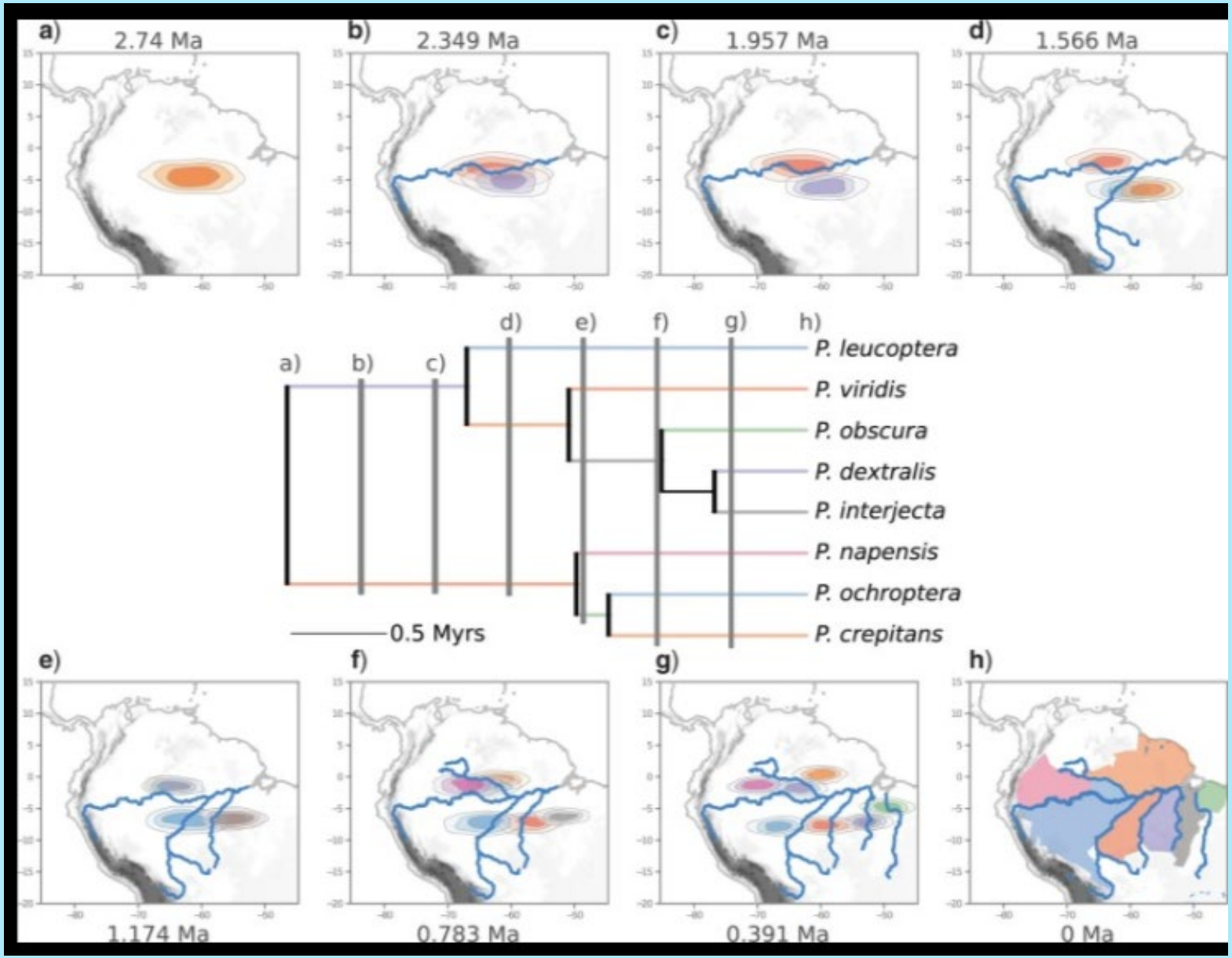
SIMULATED
EXAMPLE OF SPECIATION



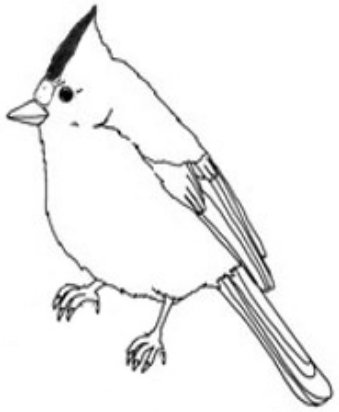
GENETIC ISOLATION LEADS TO SPECIATION

- **Allopatric speciation** – geographic separation (simplest kind)
  - Habitat changes
  - Geological events
  - Climactic events
  - Range contraction
- **Parapatric speciation**
  - No physical barriers to mating
  - Individuals more likely to mate with near neighbors
- **Sympatric speciation**
  - Sub-population exploiting new resources

LEADS TO SPECIATION

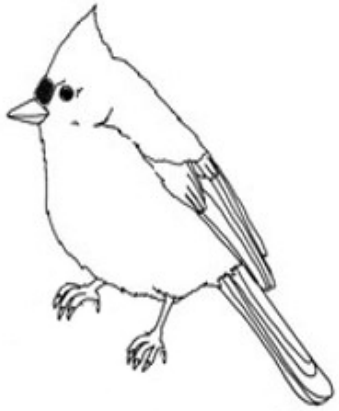
- Speciation occurs through:
  - **Selection**
    - **Natural selection** (survival of the fittest)
    - **Sexual Selection**
  - **Genetic drift**
    - Random event (hurricane, disease)
    - Part of population wiped out (non-selective)
    - Some genes proliferate
    - Other genes eliminated
    - Not due to better or worse
    - Just due to random event

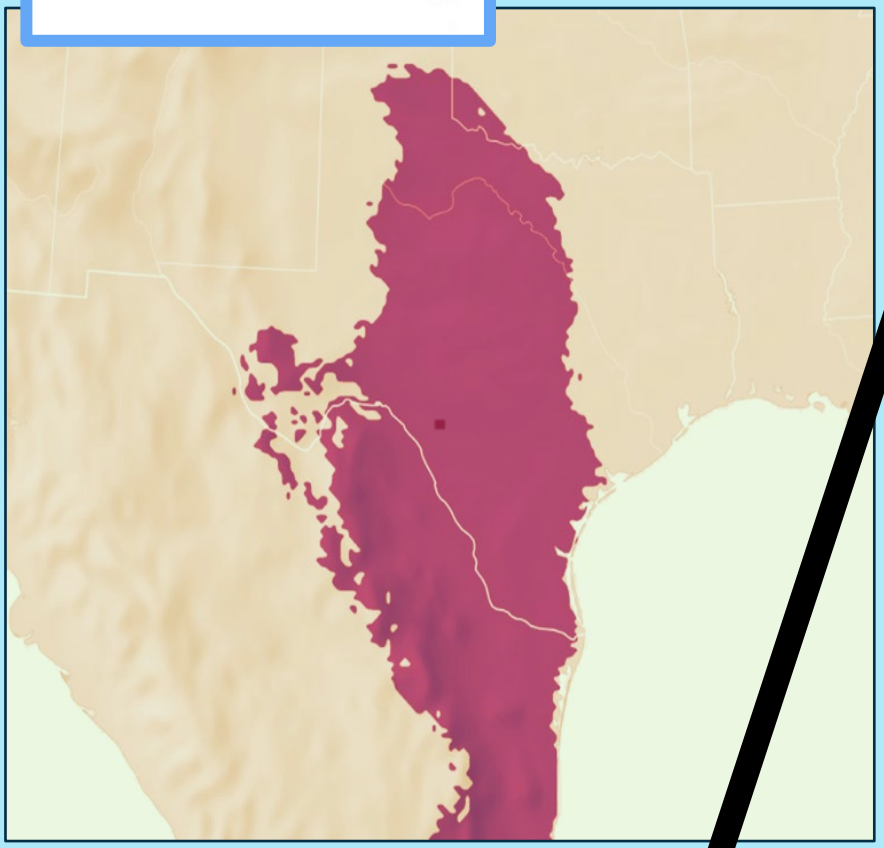
Black-crested

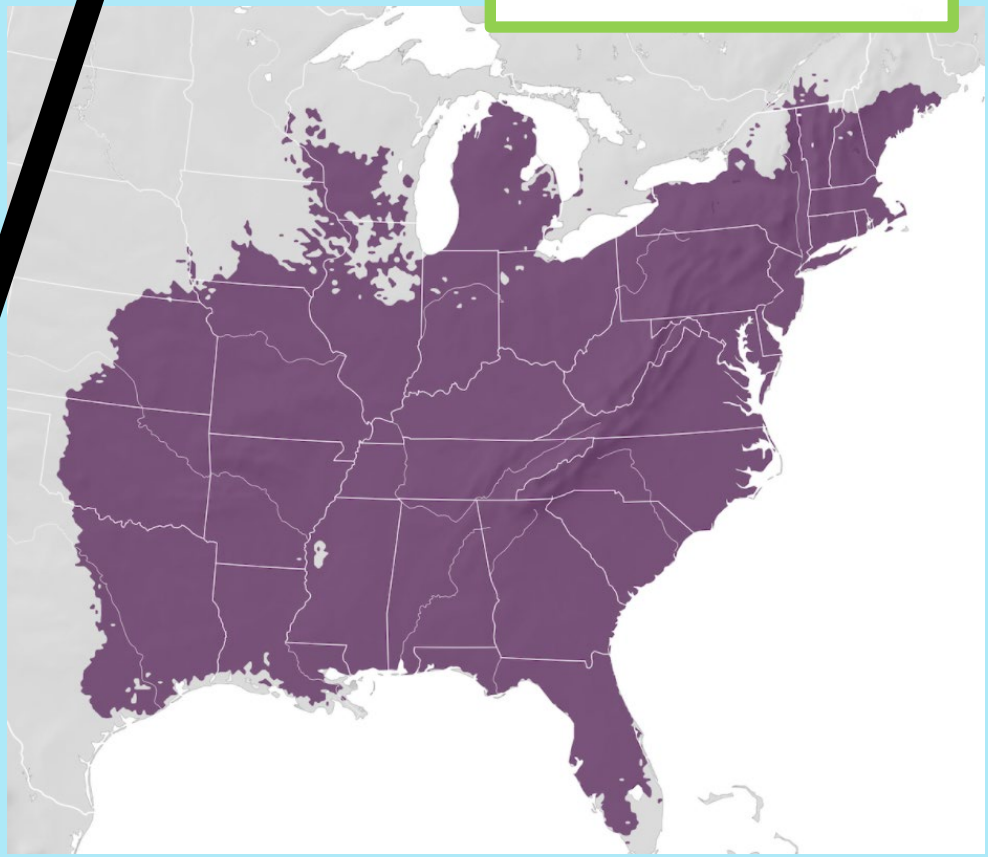


DIVERGENCE

Tufted







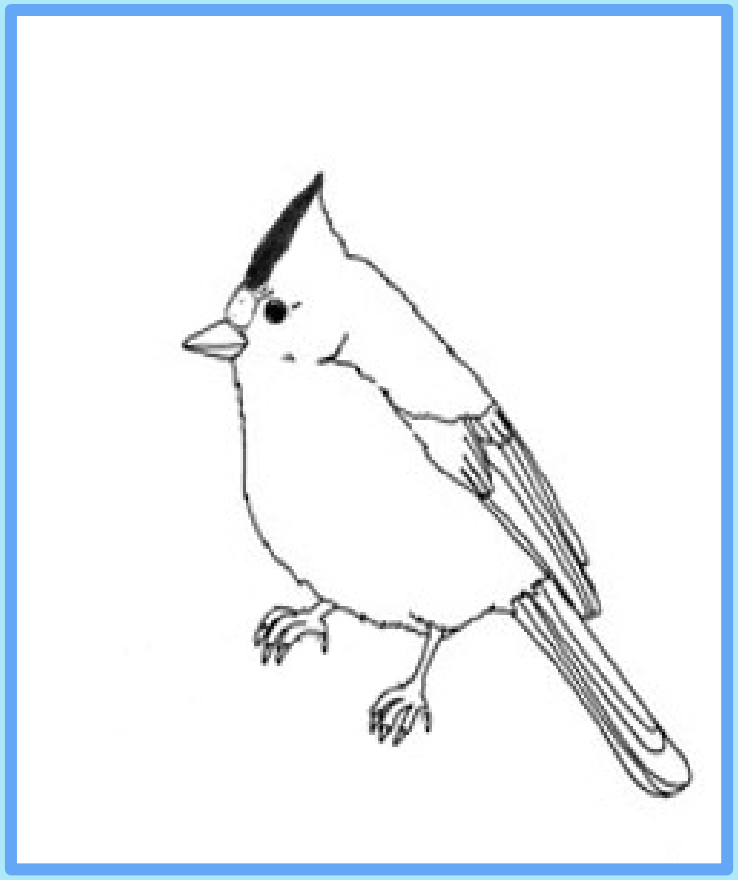
Presumably

geographic isolation

(Allopatric speciation)

Titmice of the Pleistocene

Diverged no later than 4000 years ago.



Genetic Isolation

Reproductive Barrier (s)