Biogeography

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BIOGEOGRAPHY

attempts to explain why species and higher taxa are distributed as they are, and why the diversity and taxonomic composition of the biota vary from one region to another.

INTEGRATION OF SEVERAL DISCIPLINES

1. Geology

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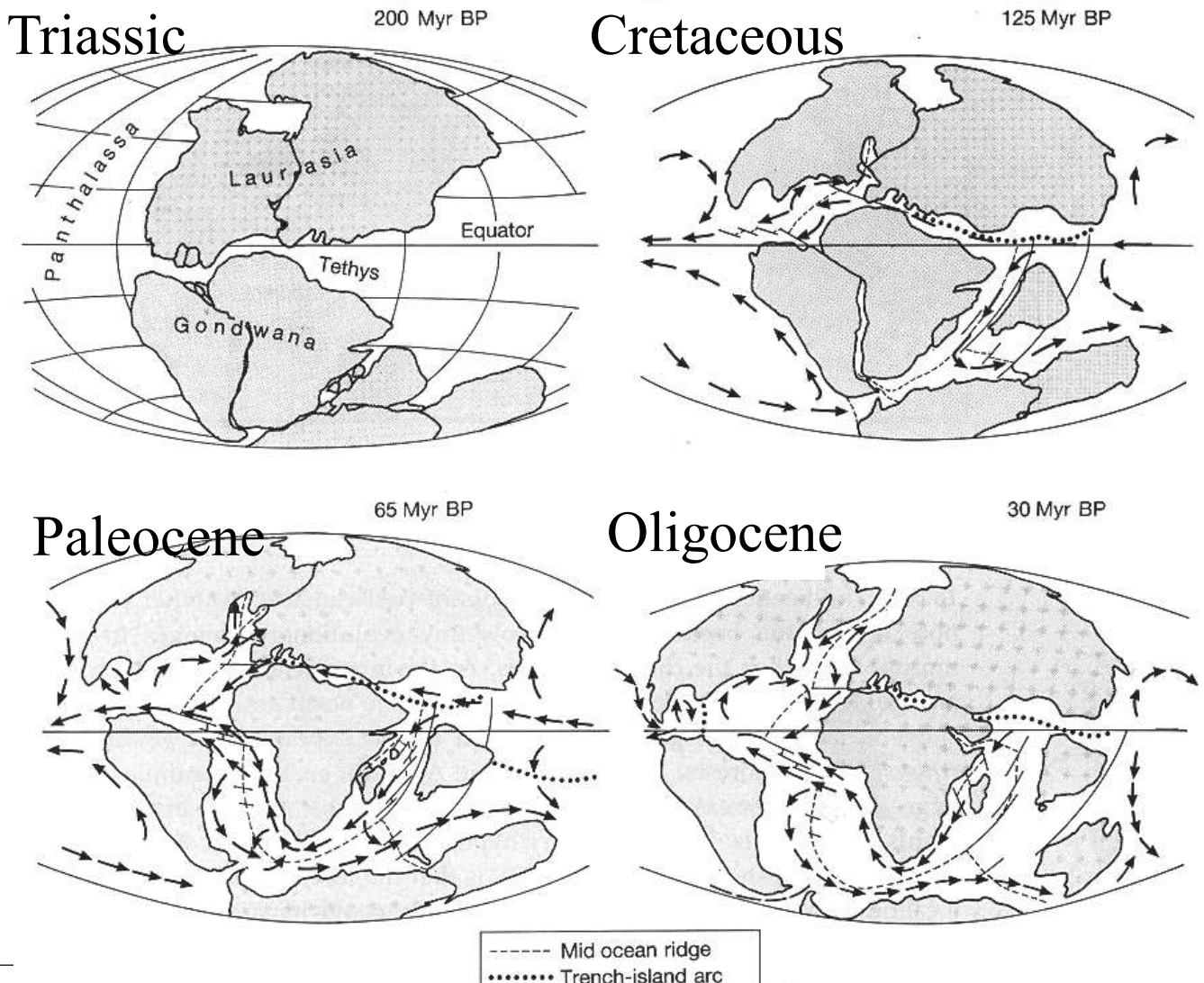

INTEGRATION OF SEVERAL DISCIPLINES

1. Geology

2. Paleontology

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Gila Monster (*Heloderma*)

Lanthanotus thought to be related to Gila monsters (weird distribution). It is really related to Monitor lizards (makes sense for biogeography).

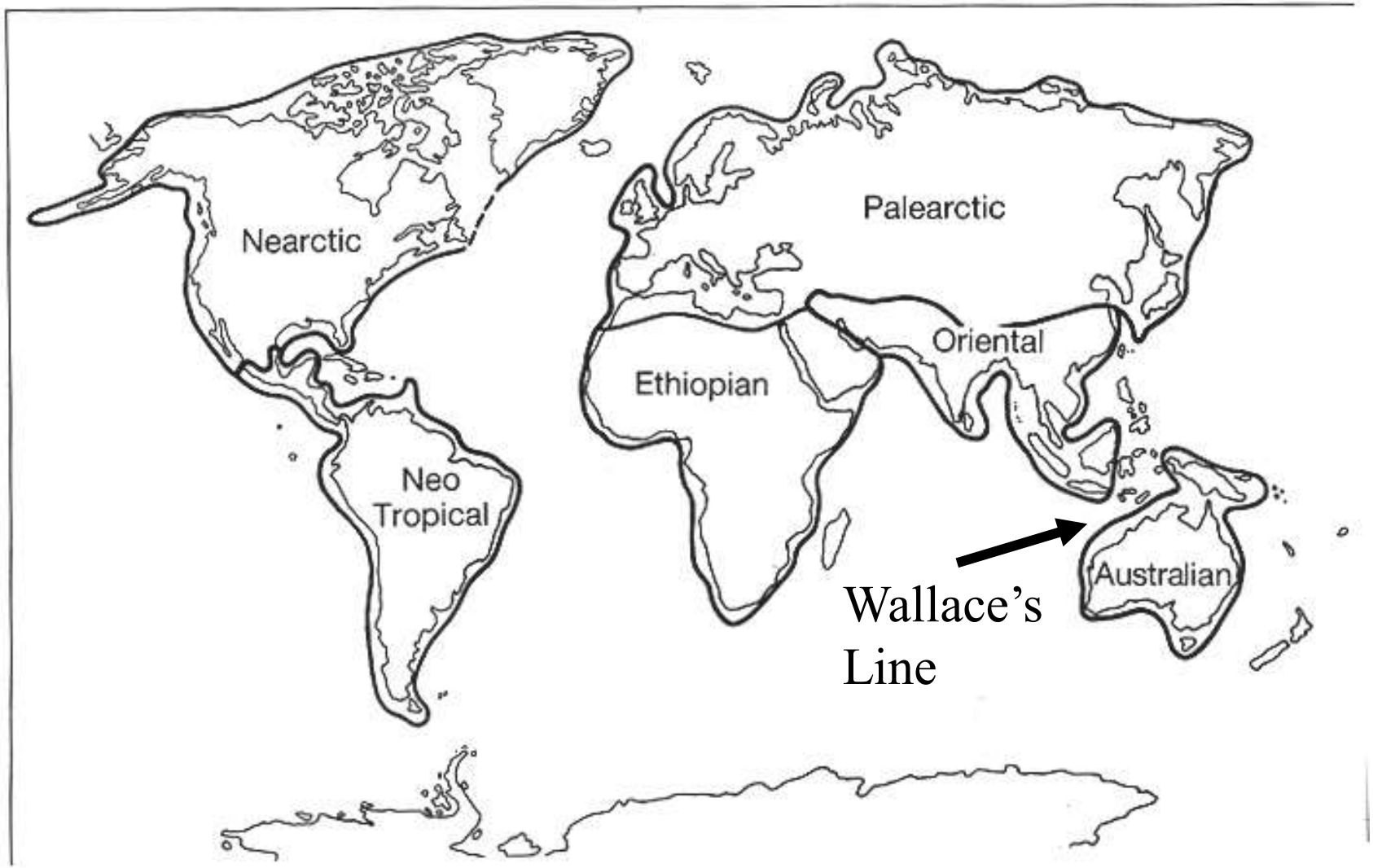
Monitor Lizard (Varanidae)

INTEGRATION OF SEVERAL DISCIPLINES

1. Geology
2. Paleontology
3. Phylogenetics
4. Ecology

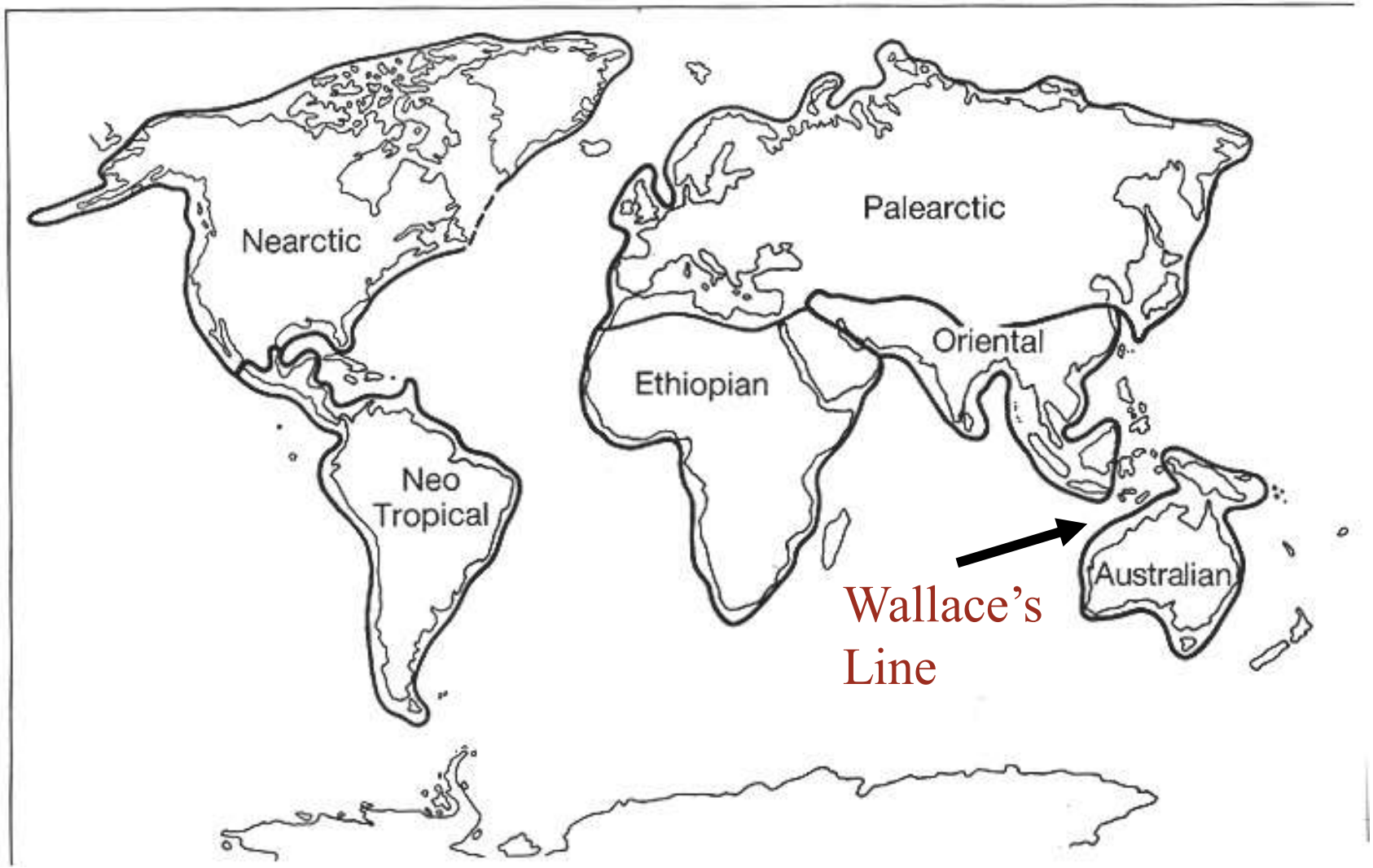
AN EXAMPLE OF BIOGEOGRAPHIC AREAS

Philip Sclater (1829-1913)

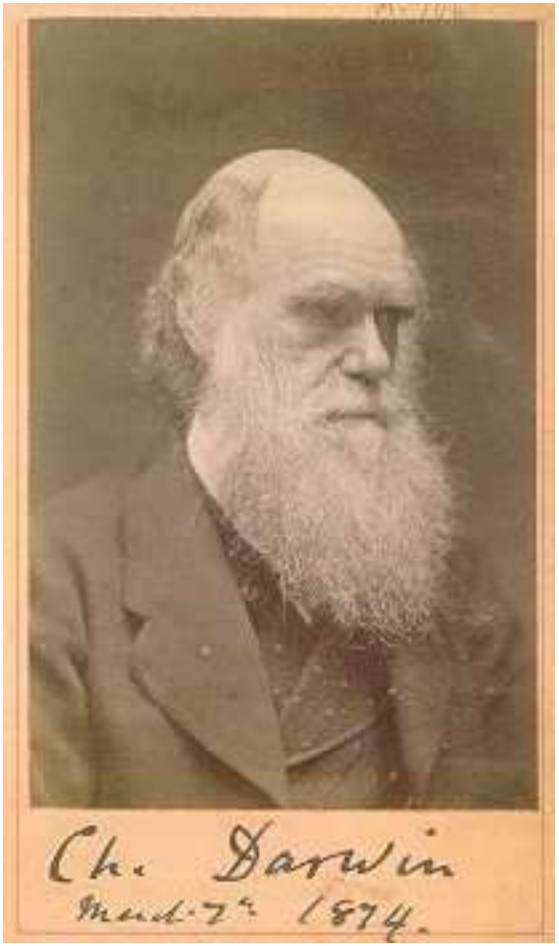


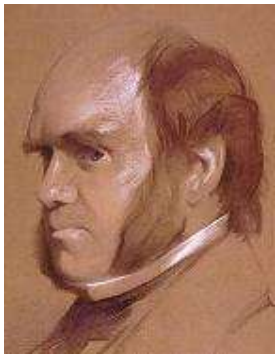
BIOREGIONS AT VARIOUS SPATIAL SCALES

AN EXAMPLE OF BIOGEOGRAPHIC AREAS



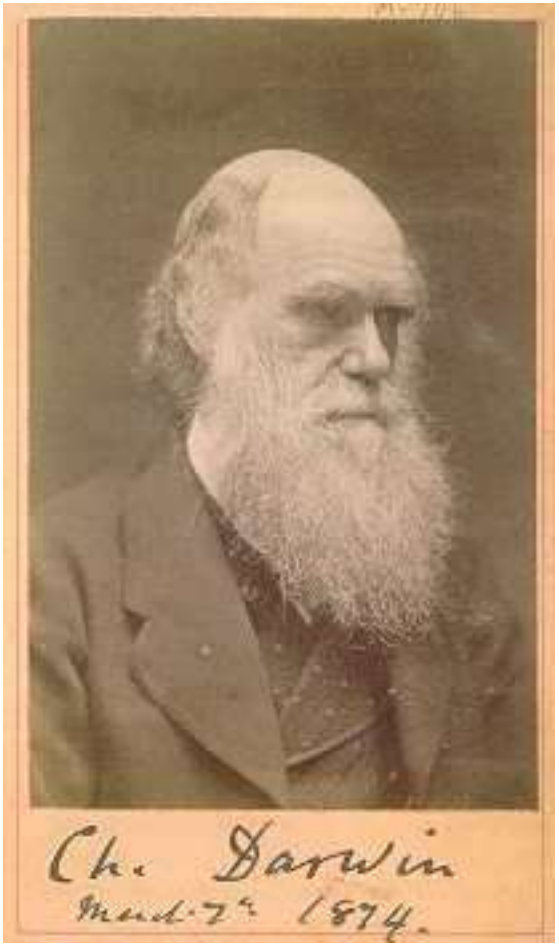
CHARLES R. DARWIN

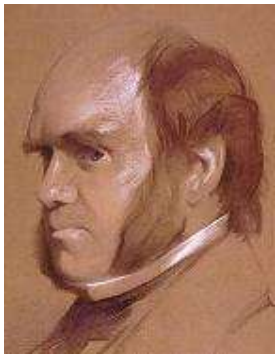




1. “Neither the similarity or dissimilarity of the inhabitants of various regions can be wholly accounted for by climatic and other physical conditions.”

CHARLES R. DARWIN





2. "Barriers of any kind…are related in a close and important manner to the differences between the productions [organisms] of various regions"

FACTORS AFFECTING GEOGRAPHIC DISTRIBUTIONS

(what might increase a species' range?)

BIOTIC

1. Adaptation to new conditions

2. Dispersal through continuous habitat

3. "Jump Dispersal" across a major barrier (sea; mountain, etc.)

FACTORS AFFECTING GEOGRAPHIC DISTRIBUTIONS

(what might increase a species' range?)

ABIOTIC

1. Climatic Regime change
2. Eustatic Events (change in sea level-provides bridges)
3. Tectonic Events (plate movements; mountains, etc.)

DISPERSAL VS. VICARIANCE HYPOTHESESES

1. Dispersal Hypothesis:
Taxon originated in one area and dispersed to the other

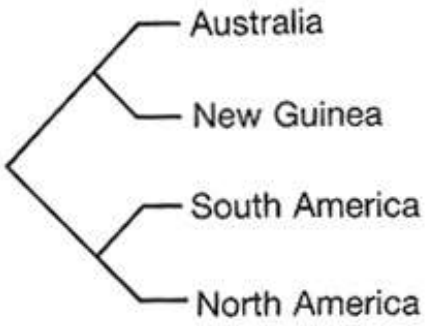
2. Vicariance Hypothesis:
Areas were formerly contiguous, and were occupied by the ancestor. Species differentiated after barrier arose.

MARSUPIAL EXAMPLE

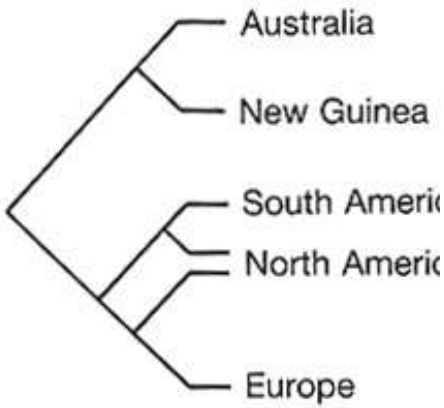
AREA CLADOGRAMS:

(a) **Marsupials**

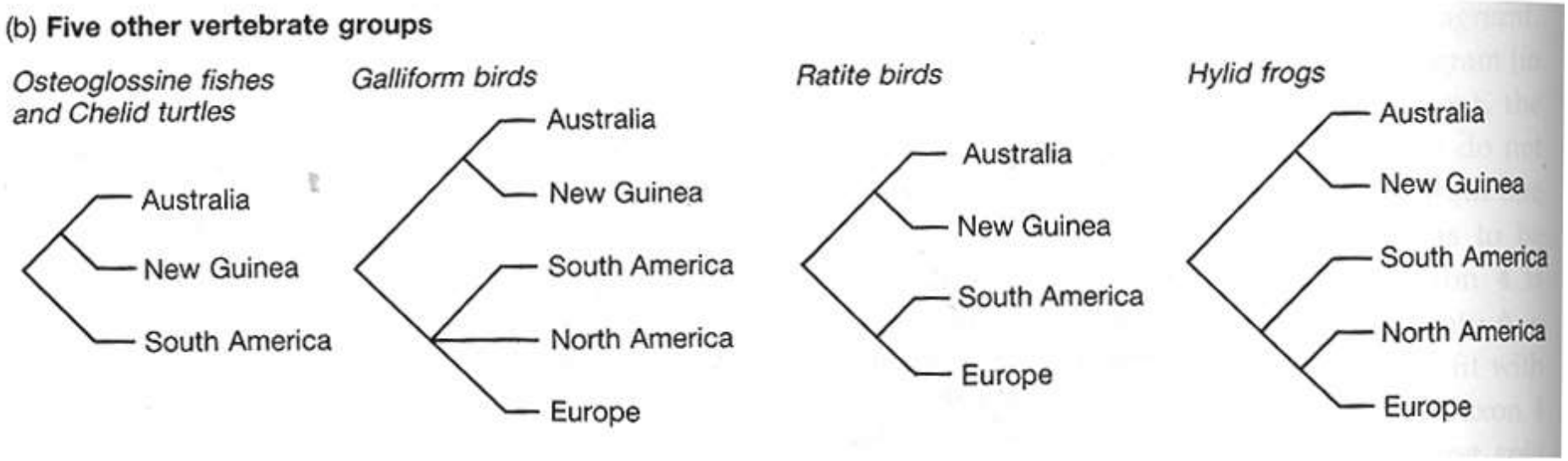
Recent marsupial groups

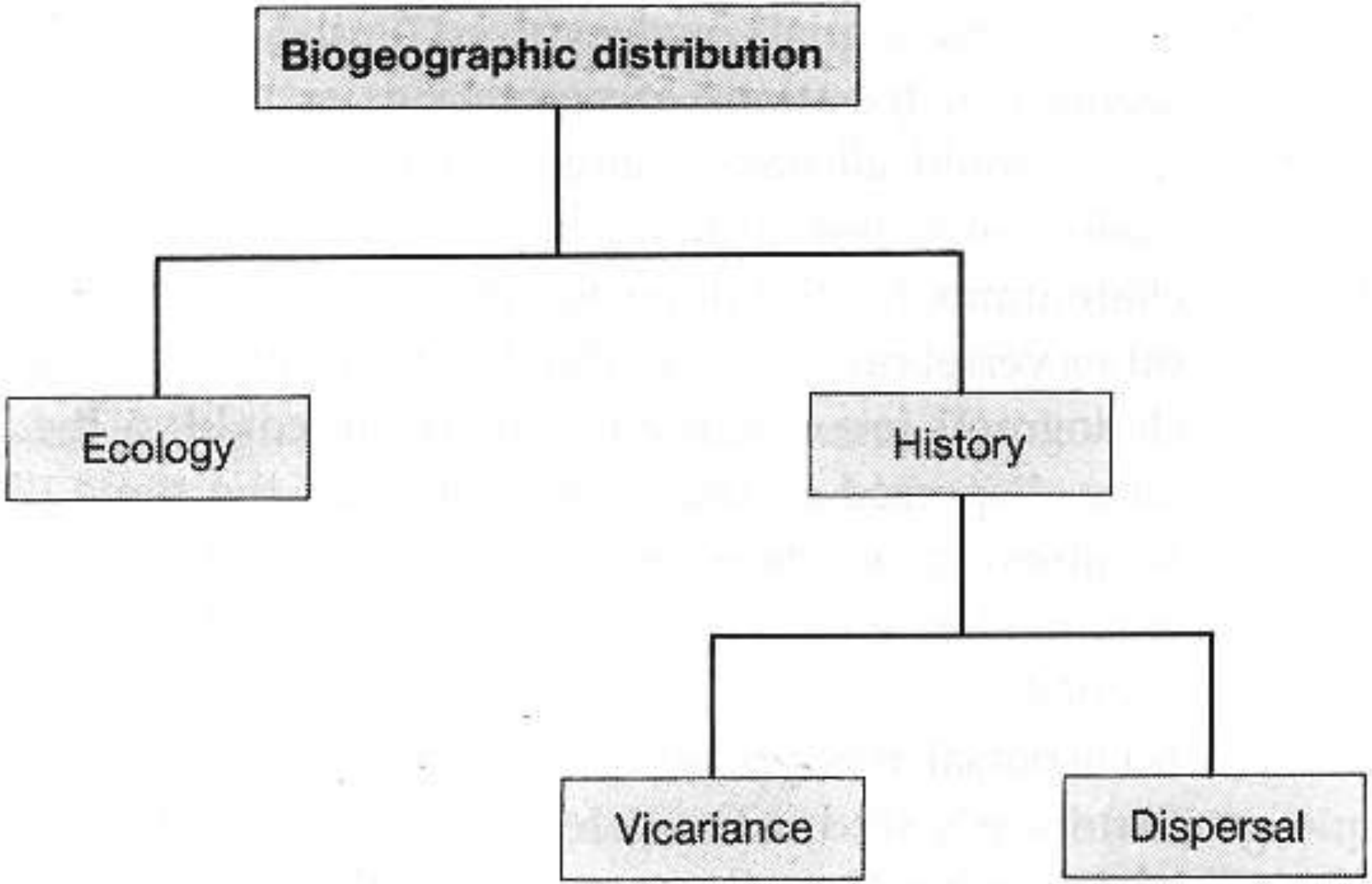


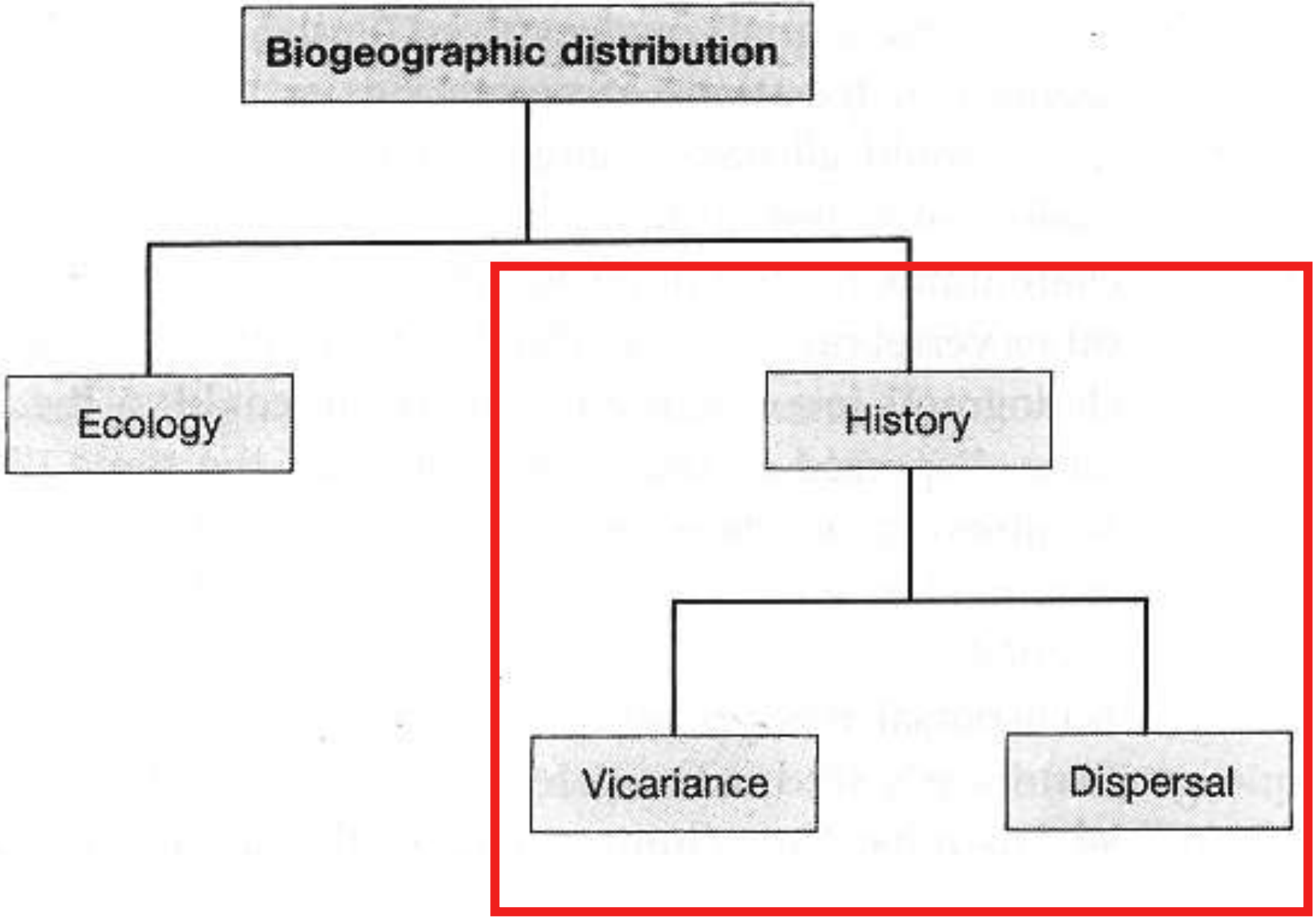
Fossil marsupial groups



CONGRUENT BIOGEOGRAPHIES
(Comparative Phylogeography)




Biogeographic distribution
Ecology
History
Vicariance
Dispersal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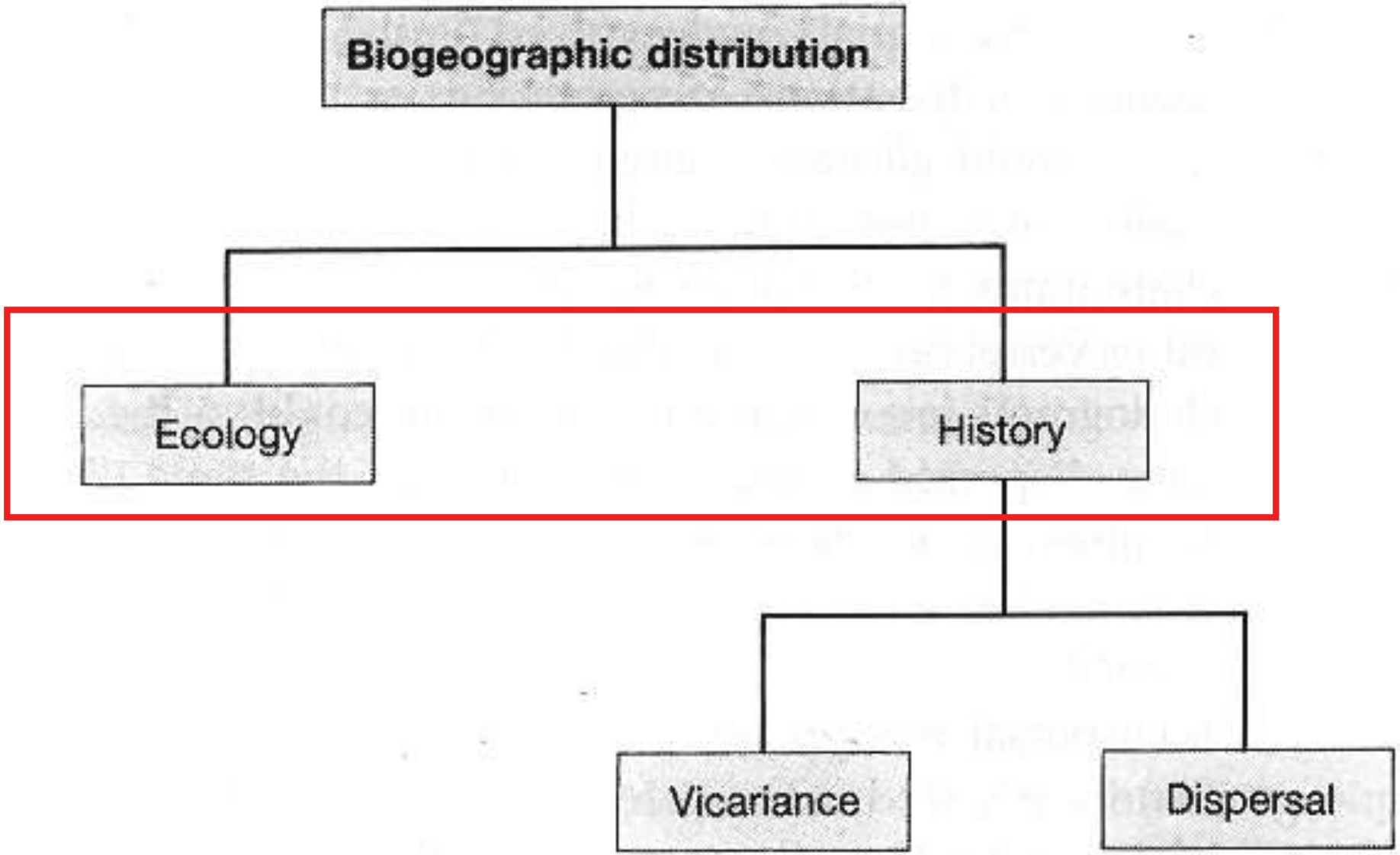
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ECOLOGY (ESSENTIAL)

A species cannot survive outside of its physiological tolerance range; its biogeography cannot contradict its ecology.

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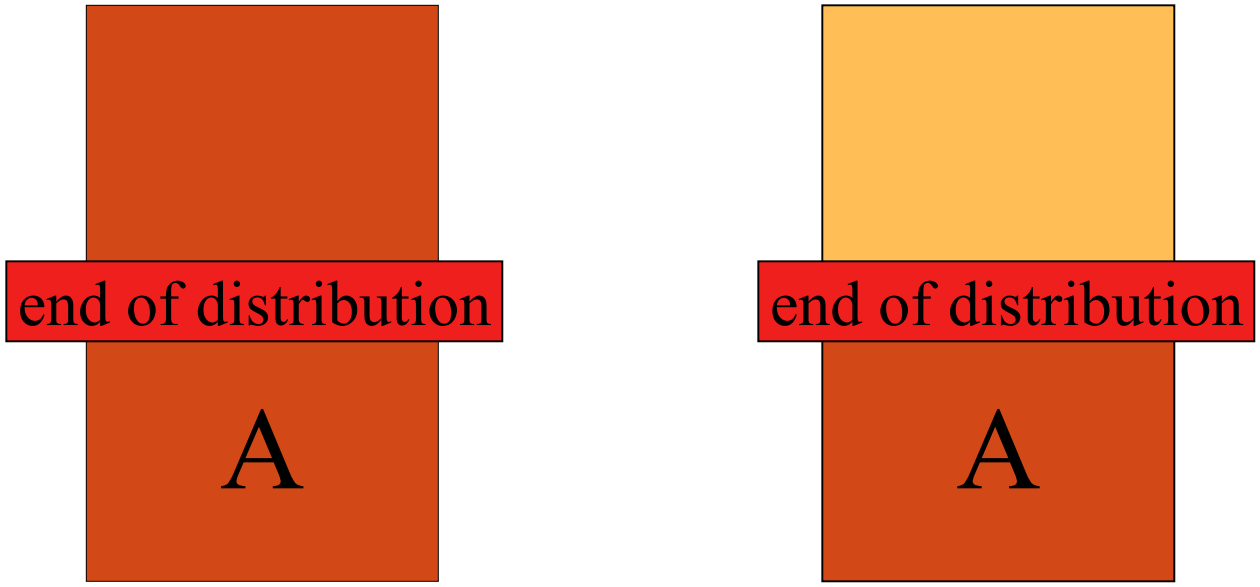
Are Ecological and Historical Factors Alternatives?

DETERMINING IF ECOLOGY OR HISTORY IS MORE IMPORTANT



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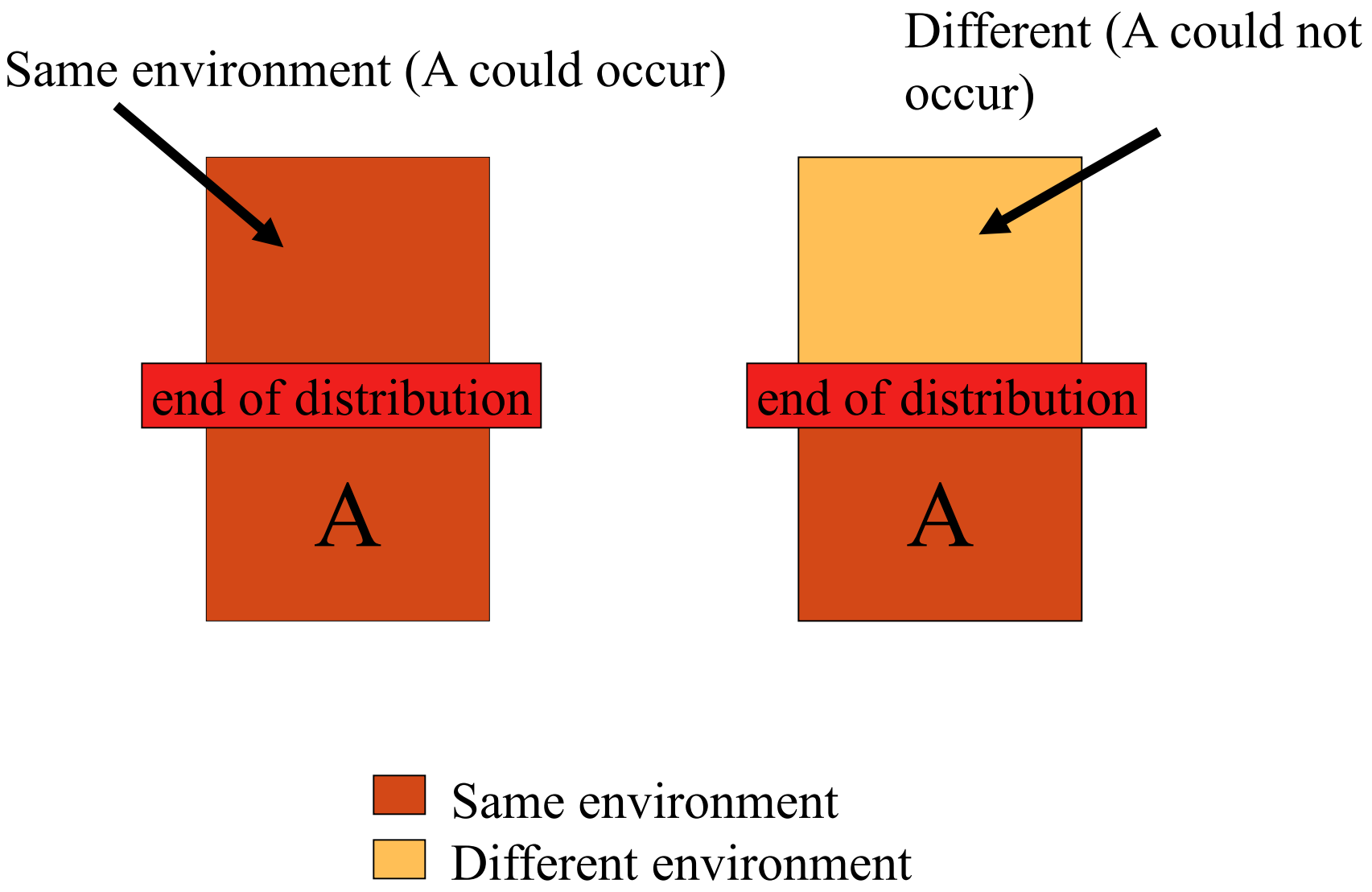

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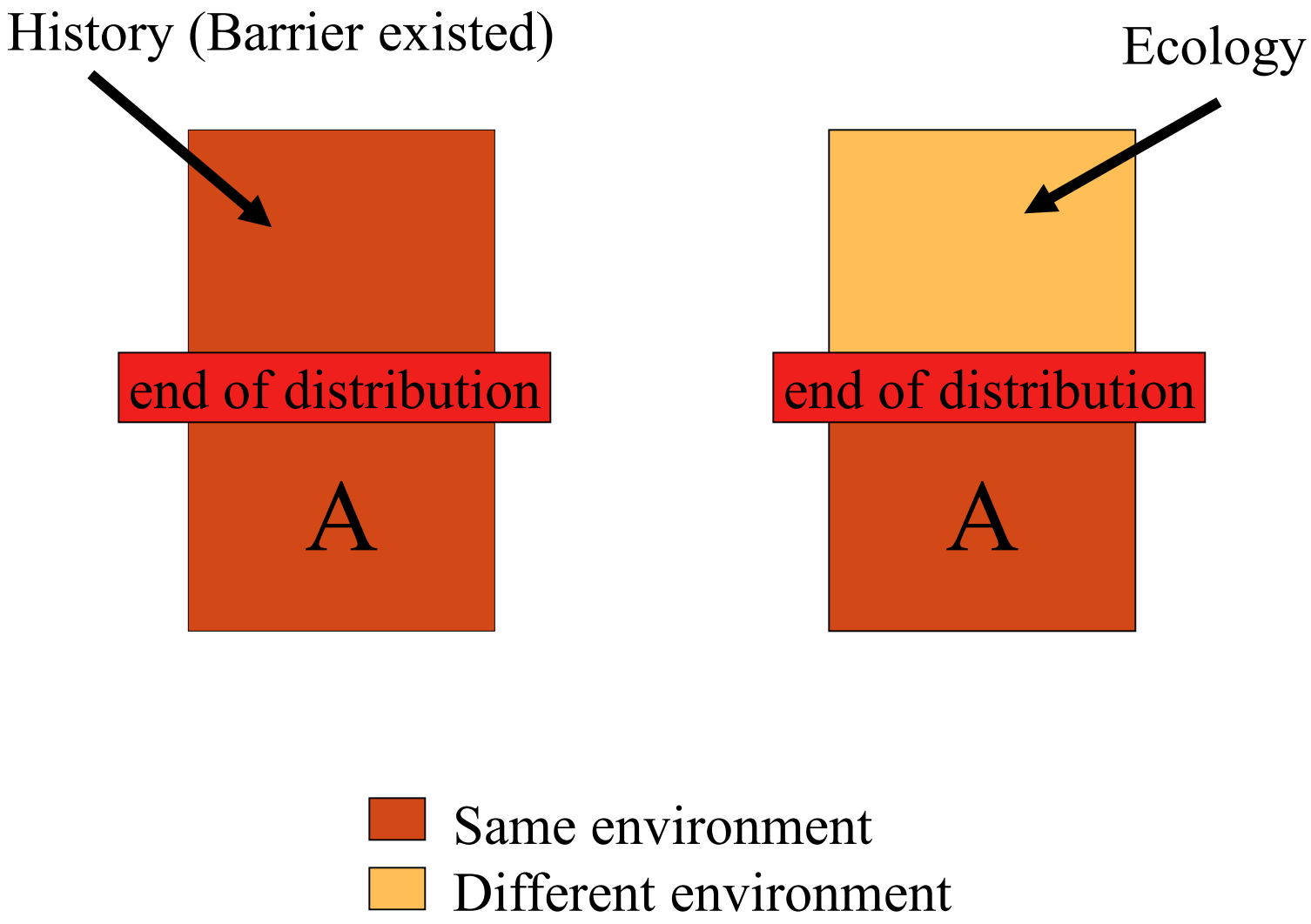
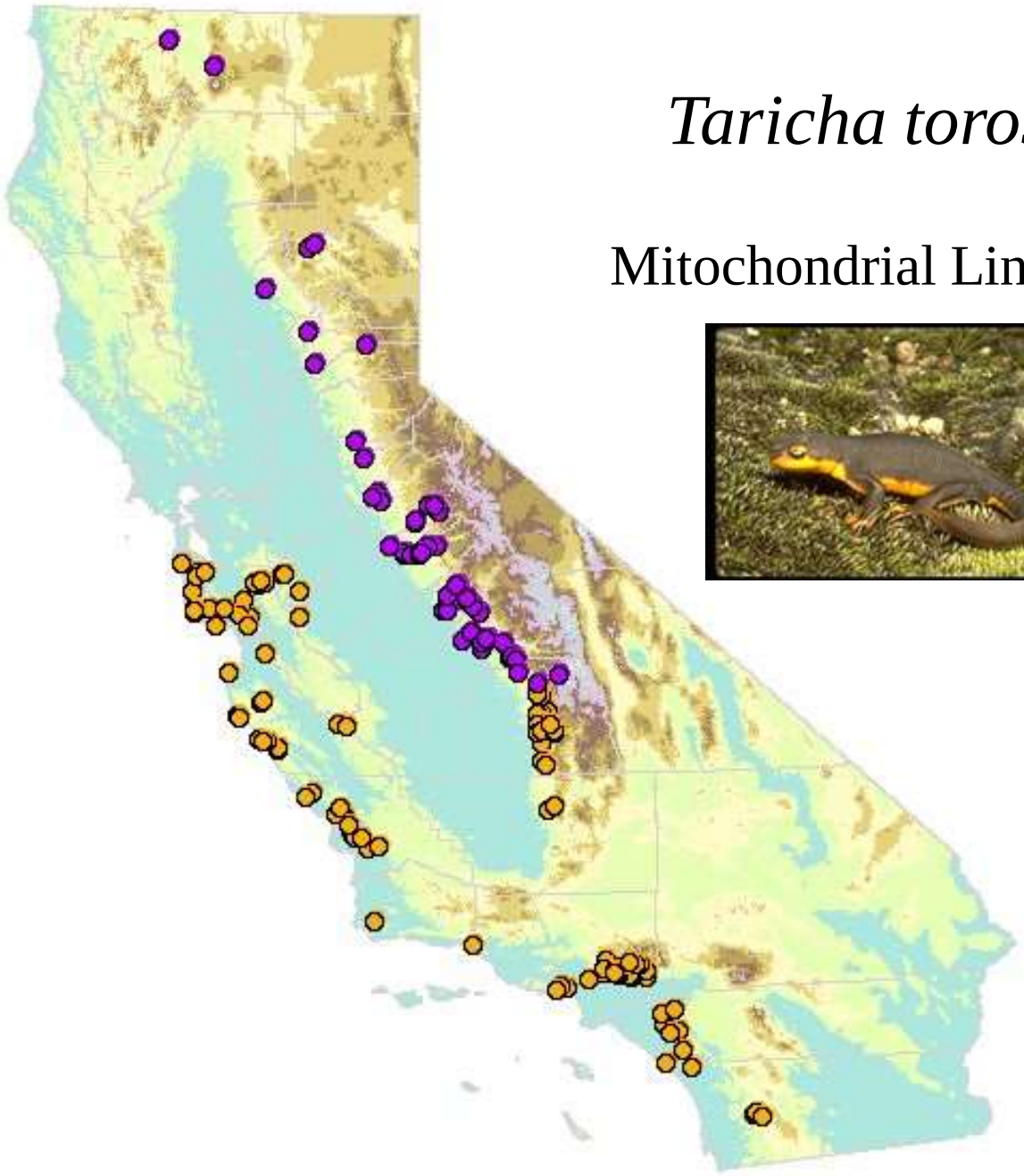


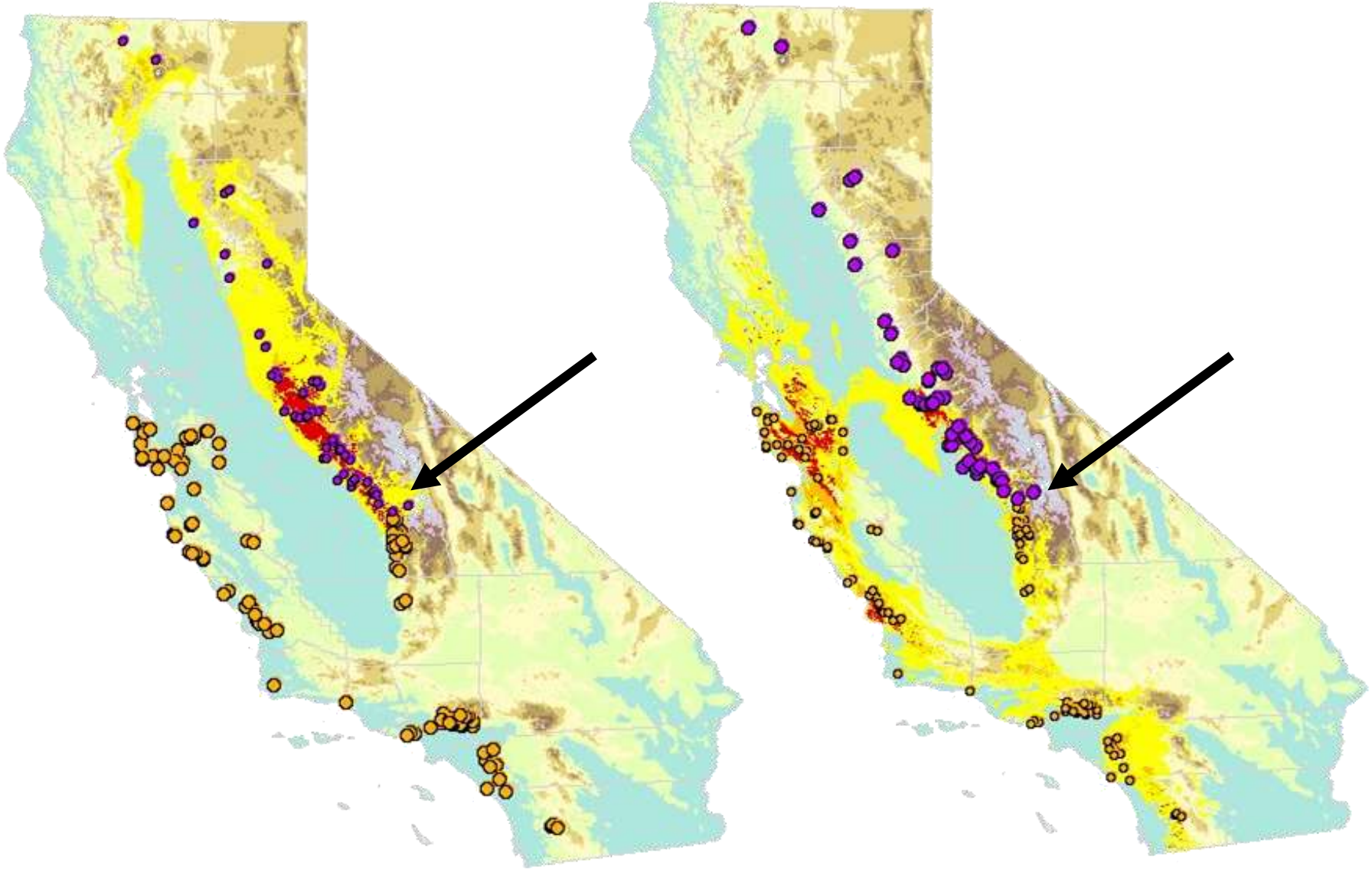


Taricha torosa

Mitochondrial Lineages

BIOCLIMATIC MODELING

(unique environmental space: selection?)



SYTEMATISTS AND ECOLOGISTS ASK DIFFERENT QUESTIONS

1) Systematists look first to evolutionary history

2) Ecologists look first to physiological tolerances and species interactions

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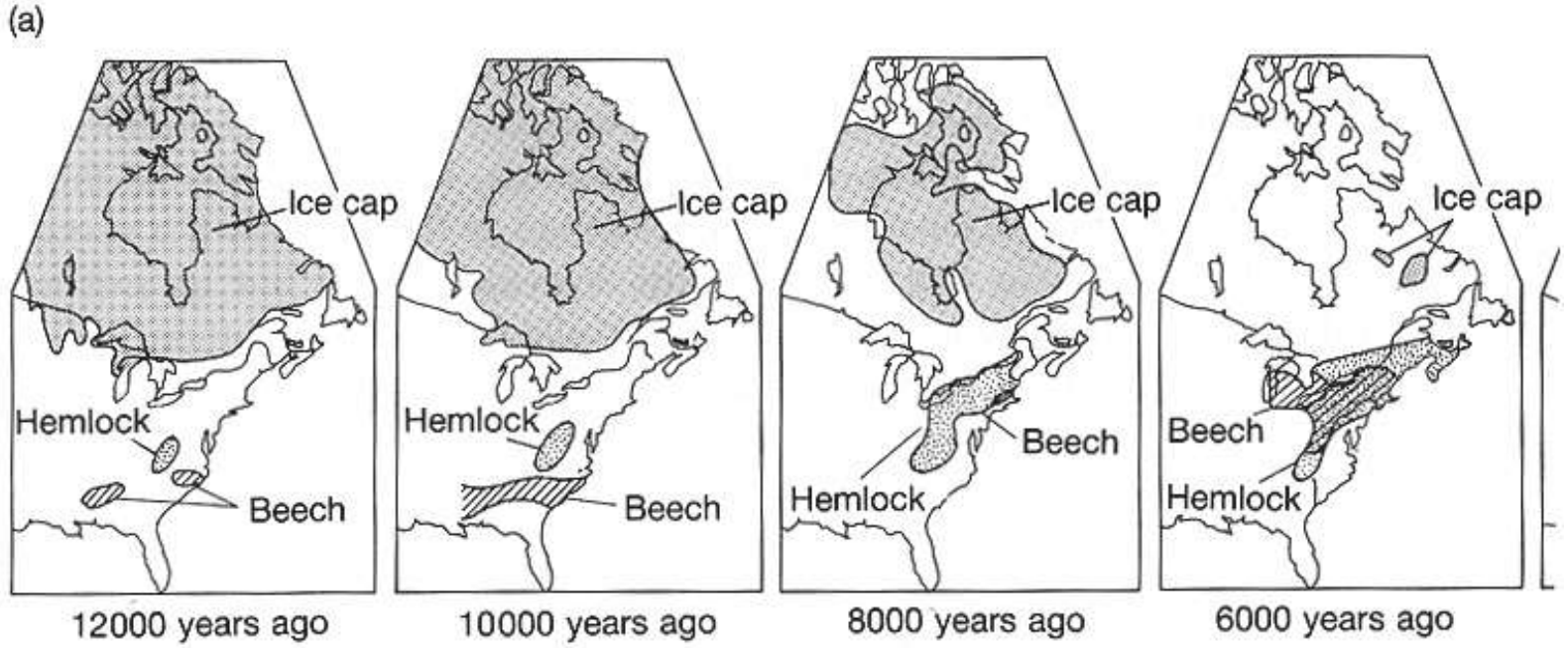


MacArthur and Wilson 1967

Theory of Island Biogeography

"Why do islands have fewer species than same area on continent?"

MacArthur and Wilson 1967

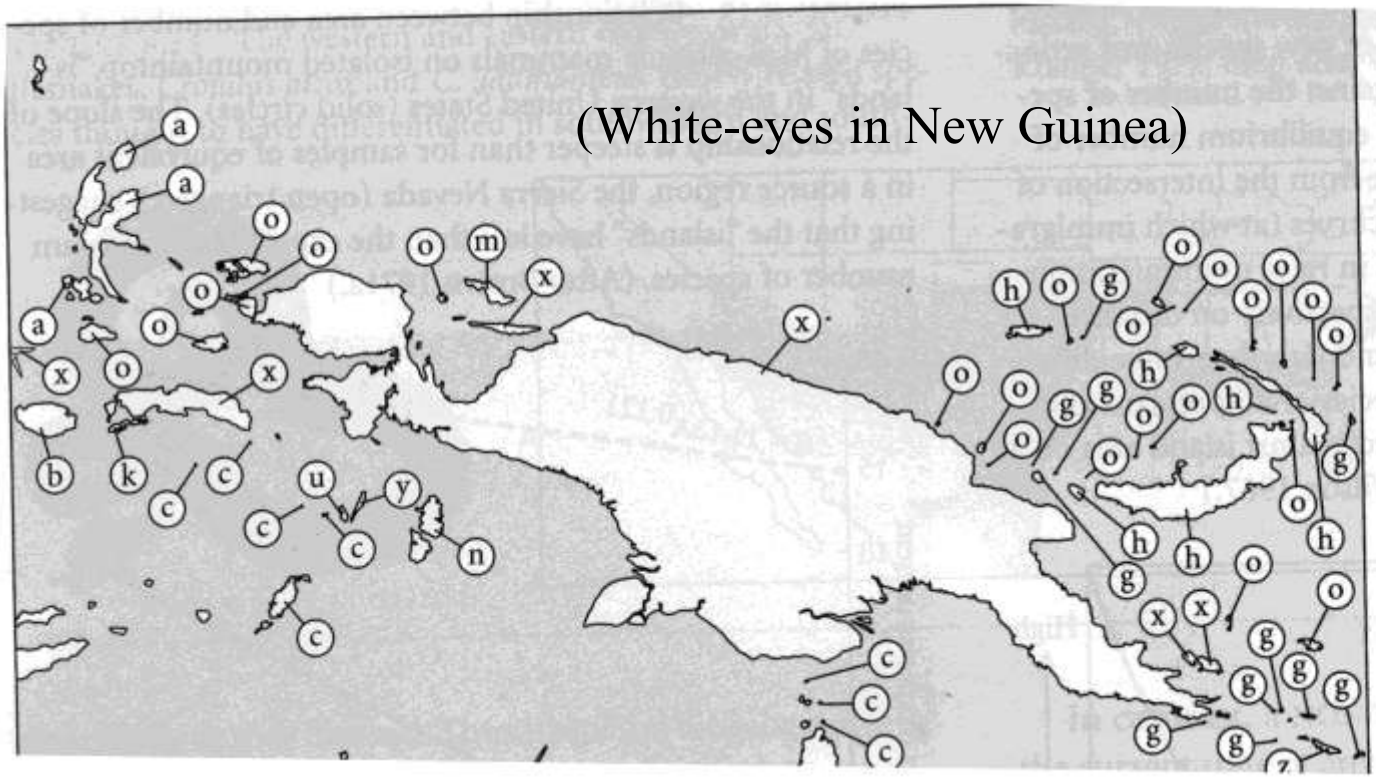
Theory of Island Biogeography

"Why do islands have fewer species than same area on continent?"

Function of SIZE of island and DISTANCE from mainland

Small islands have higher extinction rates.
Farther islands have lower probability of immigration.

CHECKERBOARD DISTRIBUTIONS: not all islands have the predicted "equilibrium" number of species



distribution" of twelve species of white-eyes (*Zosterops*) on islands in the New Guinea region. Almost no islands have more than one species, even though many of the species, each denoted by a letter, are widely distributed. (After Diamond 1975.)

Interspecific Competition (ecology) also influences particular species distributions.

CONVERGENT EVOLUTION (form of homoplasy)

Are the same niches predictably occupied by phylogenetically independent groups of organisms?

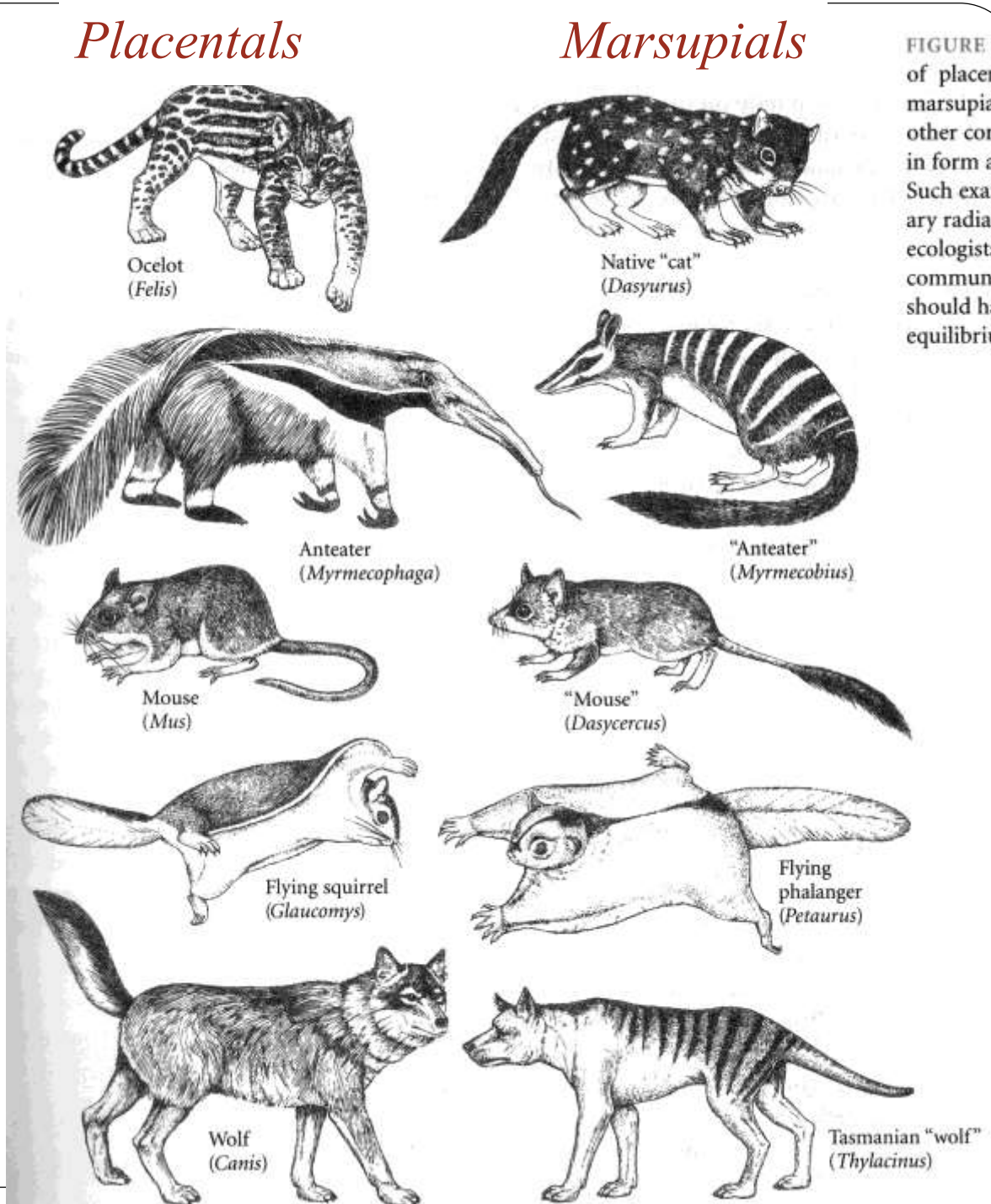


FIGURE 8.23
of placental
marsupial (ri
other contine
in form and
Such exampl
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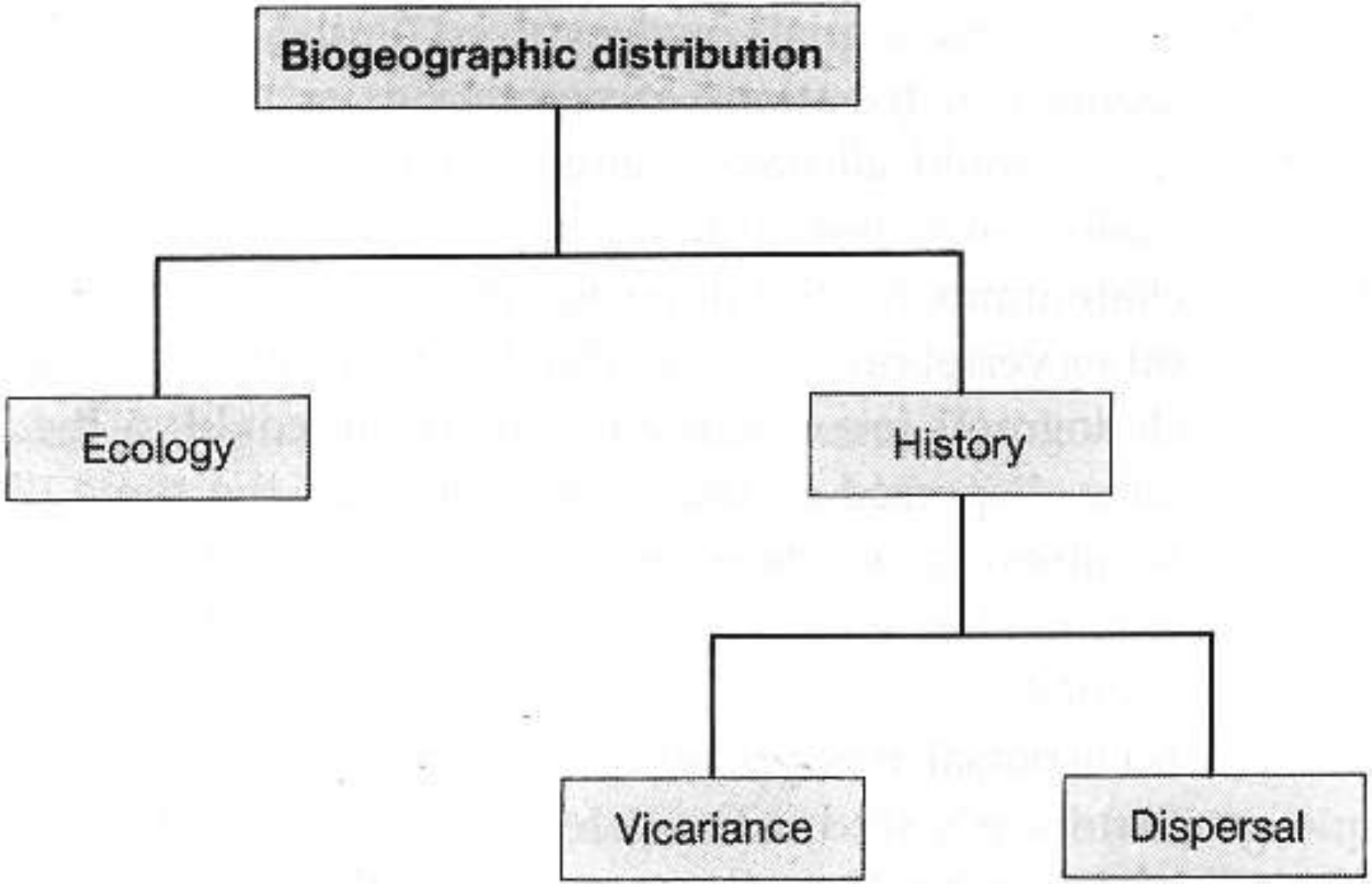
ecologists to
communities
should have
equilibrium.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