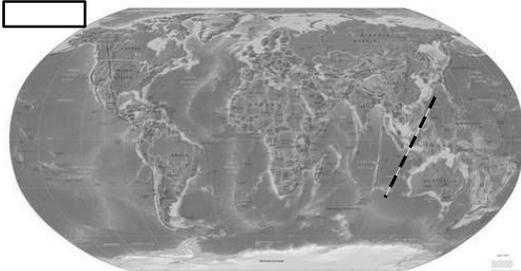


Relationships of Floras (& Faunas)

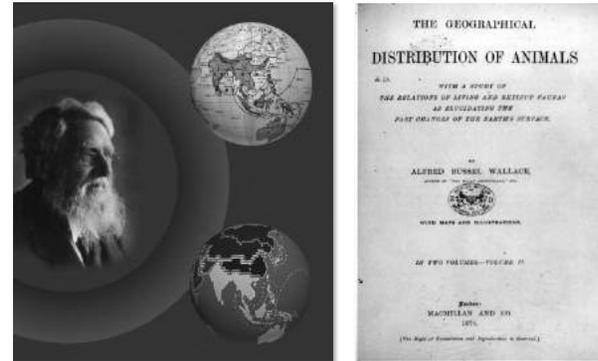
Knowledge of earth and organism histories now permit closer examination of relationships of disjunct floras and faunas.

- Southern Hemisphere temperate
- Southern Hemisphere tropics
- the Wallace Line
- Eastern Asian - Eastern North American temperate



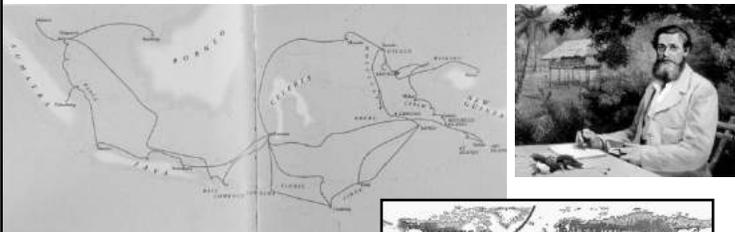
The Wallace Line

Alfred Wallace, one of the premier zoobiogeographers, wrote the definitive treatise “*Distributions of Animals*” in 1876 where he summarized the known distributions and causes of their biogeographical patterns



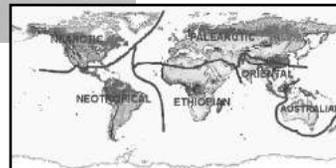
The Wallace Line

Alfred Wallace’s main interest was in the vertebrate fauna of the Indo-Malay Archipelago from Asia to Australia where he clearly saw a sharp faunistic break



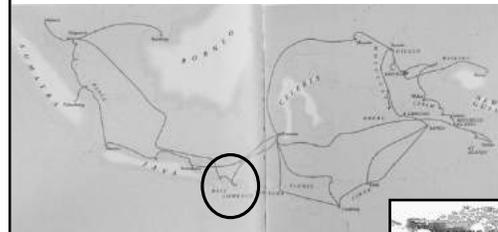
Wallace’s 1854 – 1862 expedition in Indo-Malay (1848-1852 South America with Henry Bates)

Sclater’s & Wallace’s faunistic regions



The Wallace Line

“*In the archipelago . . . there are two distinct faunas rigidly circumscribed, which differ as much as those of South America and Africa, and more than those of Europe and North America*” [Letter to Henry Bates in London (1858)]



Probably his most important trip he ever made was a 6 km ferry ride from Bali to Lombok

Wallace’s 1854 – 1862 expedition in Indo-Malay (1848-1852 South America with Henry Bates)

Sclater’s & Wallace’s faunistic regions



The Wallace Line

"In the archipelago . . . there are two distinct faunas rigidly circumscribed, which differ as much as those of South America and Africa, and more than those of Europe and North America" [Letter to Henry Bates in London (1858)]

"The boundary line often passes between islands closer than others in the same group. I believe the western part to be a separated portion of continental Asia, the eastern the fragmentary prolongation of a former Pacific continent"



Looking east from Bali across 6 km Lombok Straits



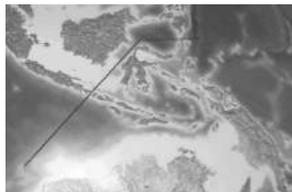
The Wallace Line

Wallace graphically depicts what has since been termed the "Wallace Line" in his book by showing birds and mammals that are found in the Oriental (Borneo, left) and Australian (New Guinea, right) sides



Cover plate from *Distributions of Animals*

The Wallace Line

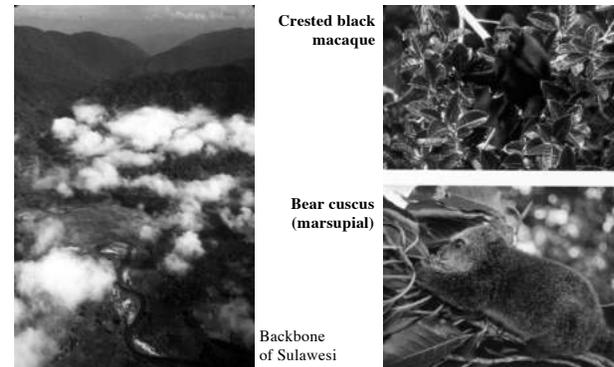


- Wallace Line — the imaginary line separating the Oriental and Australian biotas — extends between Bali and Lombok and between Borneo/Philippines and Sulawesi
- Several other lines have been proposed in the region based on particular groups of animals or plants.
- Main issue with most lines is what do with Sulawesi (Celebes)



The Wallace Line

Sulawesi, with its mixture of Oriental and Australian fauna, was so perplexing to Wallace, that he vacillated back and forth on where to place the island



Backbone of Sulawesi

The Wallace Line



The "Wallace Line" biogeographical riddle was elegantly solved with the continental drift theory of Alfred Wegener and the more recent plate tectonic basis as a mechanism for Earth evolution

Earth and Life Evolve Together

The Wallace Line

Now know that the two regions are different continental plates that have been moving independently — the Asian and Australian plates



The IndoMalay - New Guinea Archipelago area includes island groups mostly confined to either of two continental shelves:

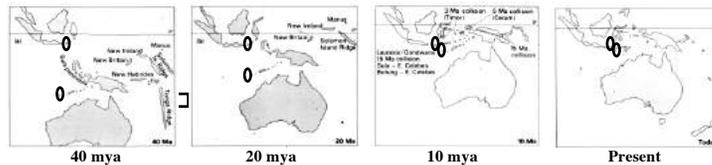
Sunda shelf — Asian

Sahul shelf — Australian

The Wallace Line

Collision of the Australian plate with the Asian plate occurred between 15-5 mya

Note the origins of Bali and Lombok, forming the Wallace Line

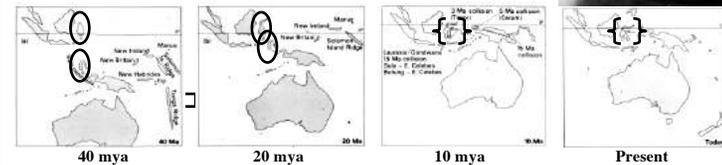


The Wallace Line

Collision of the Australian plate with the Asian plate occurred between 15-5 mya

Note the origins of Bali and Lombok, forming the Wallace Line

Sulawesi is a hybrid island from both plates!



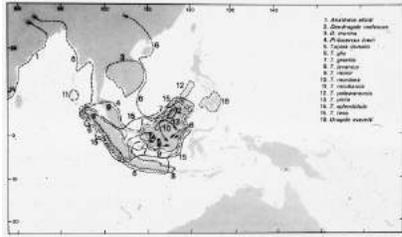
The Wallace Line – is it real?



Tree shrews (family Tupaiidae) were indicated by Wallace as honoring this biogeographical line. An Asian group whose entire range gets as far east as Bali and Borneo but not to Lombok or Sulawesi



Tree shrew family & individual species distributions



The Wallace Line – is it real?

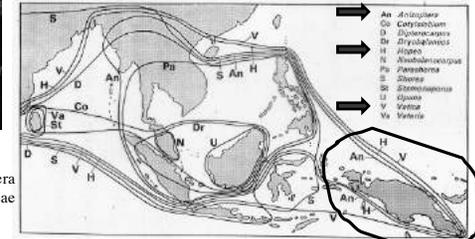


Borneo diptercarp

Do plants honor the Wallace Line?

All but 3 of the genera of Dipteroocarpaceae honor the Wallace Line – to New Guinea

Surprising considering the winged fruit in the family is designed for (limited?) dispersal



Distribution of genera of Dipteroocarpaceae

A Biogeographical and Phylogenetic Analysis of Dipteroocarpaceae: Do They Honor the Wallace Line?
 Amelia Krug and Kenneth Sysma
 University Of Wisconsin, Department Of Botany
 amelia.krug@gmail.com, kjsysma@wisc.edu

The family Dipteroocarpaceae (Malvales) is divided into three subfamilies (Dipteroocarpoideae, Miconioideae, and Pterosporoideae) and a geographical distribution. Dipteroocarpaceae consists of 23 genera and about 475 species, most of which are found in Southeast Asia. The majority of species are found in the island of Sumatra and Java to West Malacca (Culley et al., 1994). All three species radiations directly with the biogeographic boundary of the Wallace Line. However, some genera including *Anisodactylus*, *Halesia*, *Vatica*, *Sida*, and *Dipteroctenium* have crossed over the boundary of the line (Whitmore 1988, Fig. 2). The goal of this study is to determine whether the species crossed over the Wallace Line subsequent to the collision of the Sunda and Sahul Plates 25 Ma, or earlier and over greater oceanic distances.

Materials and Methods
Taxon Sampling: The cpDNA sequences (trnL-trnF and rbcL-rps16) intergenic spacer of 23 species from the subfamily Dipteroocarpoideae, 1 species from the subfamily Miconioideae, and 2 wingless species were gathered from GenBank and aligned within MAFFT v. 4.0.0.0 S.

Analyses: Divergence times were estimated using BEAST v. 2.0.9 using fossil date and divergence estimates of Dipteroocarpaceae (Meyer 1993), Dipteroocarpaceae (Dietrich et al., 2011), Dipteroocarpaceae (Kajiwara et al., 1995), Malvales (Dobson et al., 2005) and Panaceae and Malvaceae (Lafont et al., 2010) as priors.

Results and Discussion
 The shortest distance between the plates after collision is around 20 mls between Bali and Lombok. Most flora and fauna presumably evolved when separated by a sea exceeding 1000 m in and remains drastically different (mostly in the Sunda and Sahul areas (Whitmore 1988)). The three species that jumped eastward over the Wallace Line most likely did so over shorter distances while their parent species remained in island areas of distribution. For some species, this may not be the case and the parent species may more largely distributed than these recently diverged.

Further research regarding the dispersal capabilities of the dominant two-winged fruit of dipteroocarpaceae and clear study of the topology of large geographically distributed species are needed to clear up discrepancies.

Dipteroocarpaceae chronogram

3 genera and 8 species make it to New Guinea on Sahul Shelf . . .

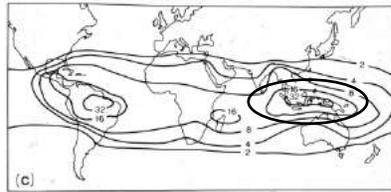
. . . and within last 10 myr – so dipteroocarps do honor Wallace’s Line!

The Wallace Line – is it real?



Do palms honor the Wallace Line?

Greatest center of diversity of palms is in the IndoMalay archipelago — how do they respond to the Wallace Line?



The Wallace Line – is it real?

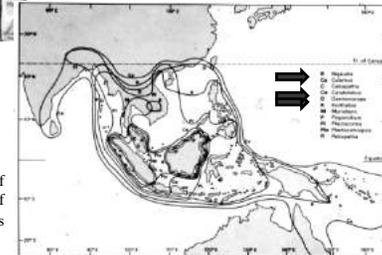


Rattan palm

Rattan palms are essentially Asian with all but 3 genera restricted west of Lombok and Sulawesi

For the 3 genera east of Wallace Line, only 1 species each crosses the line

but timing of these dispersals east are not known



Distribution of different genera of rattan palms

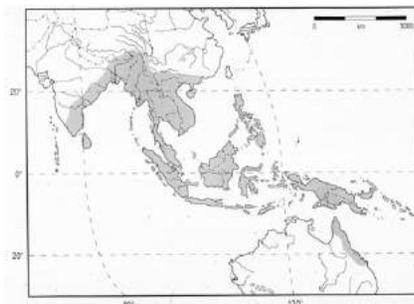
The Wallace Line – is it real?



fishtail palm

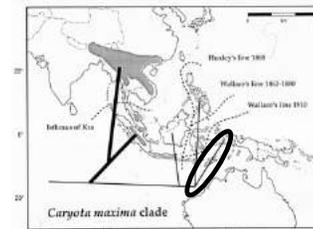
The genus *Caryota* (fishtail palms) is widespread across the IndoMalay - New Guinea region

Does it NOT support the Wallace Line?



Distribution of *Caryota*

The Wallace Line – is it real?



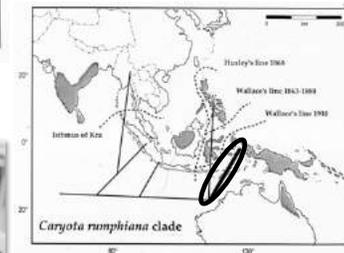
Species relationships within two different groups of fishtail palms and their biogeographical distributions



Bill Hahn

Although fishtail palms appear not to honor the Wallace Line as a genus, only the most recent speciation events in each clade have generated species crossing the line.

Perhaps these occurred after plate contact occurred? – no dates are available yet



The Wallace Line – is it real?



Gum eucalypt

Eucalyptus (Myrtaceae) is an Australian genus and basically honors the Wallace Line from the east

Date of 4 species in Wallacea not known

