University of Anbar

College of Science

Department of Applied Geology

Tectonics

Title of the lecture

Continental drift hypothesis

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Continental Drift Hypothesis

Alfred Wegener, German meteorologist, proposed that the present distribution of continents and oceanic basins had evolved only recently. According to Wegener, the continents had once fit together to make one vast supercontinent, which he named **Pangaea**, later fragmented into separate continents that then drifted apart, moving slowly to their present positions Fig. 1.

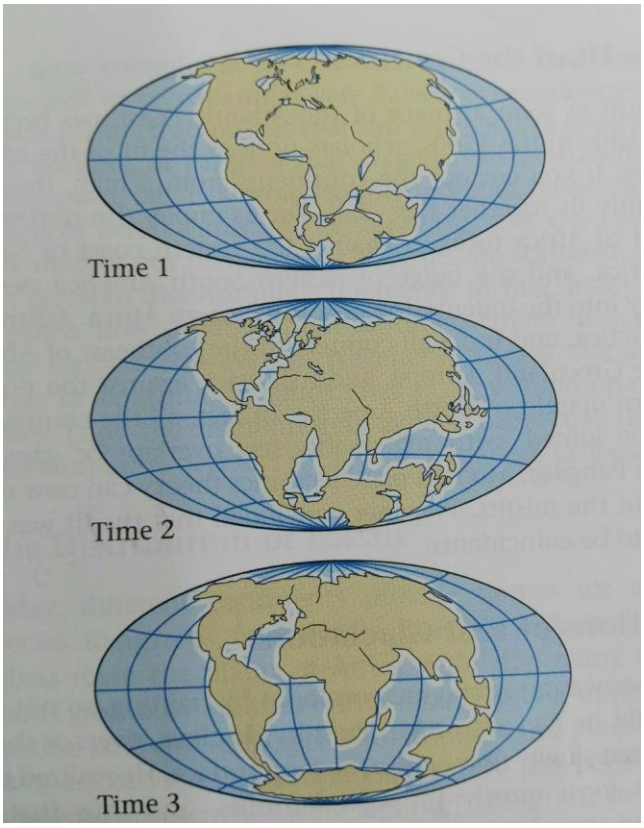

Fig. 1. Wegener image of Pangaea and its subsequent breakup and dispersal. He suggested that the continents drift apart.

At the beginning the hypothesis was rejected but in the 1960s of the last century the geologists had accepted it when the geologist **Harry Hess** proposed that continents drift apart because new oceanic floor forms between them by a process labeled **sea – floor spreading**, and that continents move toward each other when the old ocean floor sink back down into the Earth´s interior, a process now called subduction.

Evidences of Continental Drift

1. The fit of the continents.
2. Locations of past glaciations.
3. The distribution of the equatorial climatic belts.
4. The distribution of fossils.
5. Matching geological units.

The fit of the continents

Fig. 1 shows, for example, the northwest cost of Africa tucks in against the eastern cost of North America, and the bulge of eastern South America fit with the indentation of southwestern Africa. Australia, Antarctica, and India all connect to the southeast of Africa.

Locations of past glaciations

When Wegener plotted the locations of till (glacial deposits) deposited by the late Paleozoic glaciers, he found that in this time interval glaciers occurred in southern South America, southern Africa, southern India, Antarctica, and southern Australia places that are all now widely separated from one another and, with exception of Antarctica, do not currently lie in cold polar regions Fig. 2a, but all the late Paleozoic glaciated areas lie adjacent to each other on a map of Pangaea Fig. 2b.

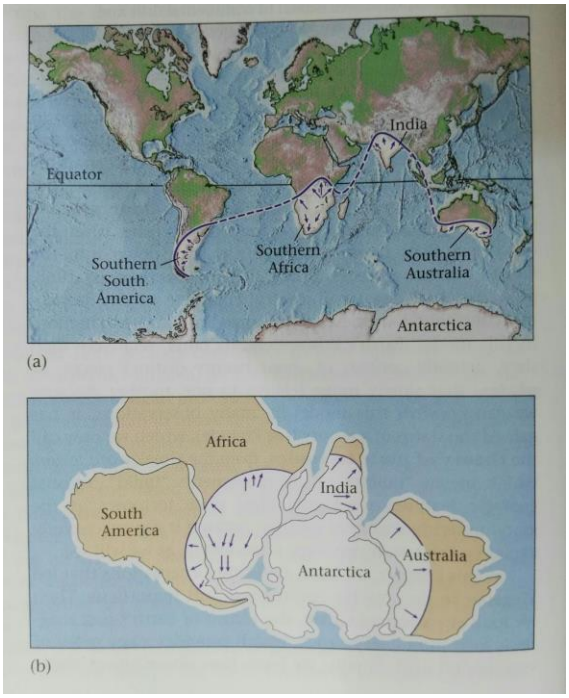

Fig.2. (a) The distribution of the late Paleozoic glacial deposits on a map of the present – day earth. The arrows indicate the orientation of striations. (b) The distribution of these glacial deposits on a map of the southern portion of Pangaea.

The distribution of the equatorial climatic belts

If the southern part of Pangaea lies in the south pole at the end of the Paleozoic era, then during this time interval southern North America, southern Europe, and northwestern Africa would have straddled the equator and would have had tropical or subtropical climates. Thick deposits of plant material accumulate in tropical regions, and when deeply buried this material transforms into coal. Large reefs also bult by coral like organisms develop offshore. On either side of the tropical belt, contain deserts, an environment for sand – dune formation and the accumulation of salt from evaporating seawater or salt lakes. Above deposits, now day, are apart from equatorial, tropical, and subtropical climates Fig. 3. Thus, the distribution of late Paleozoic coal, reef, salt, and sand – dunes deposits supported Wegener´s proposal.

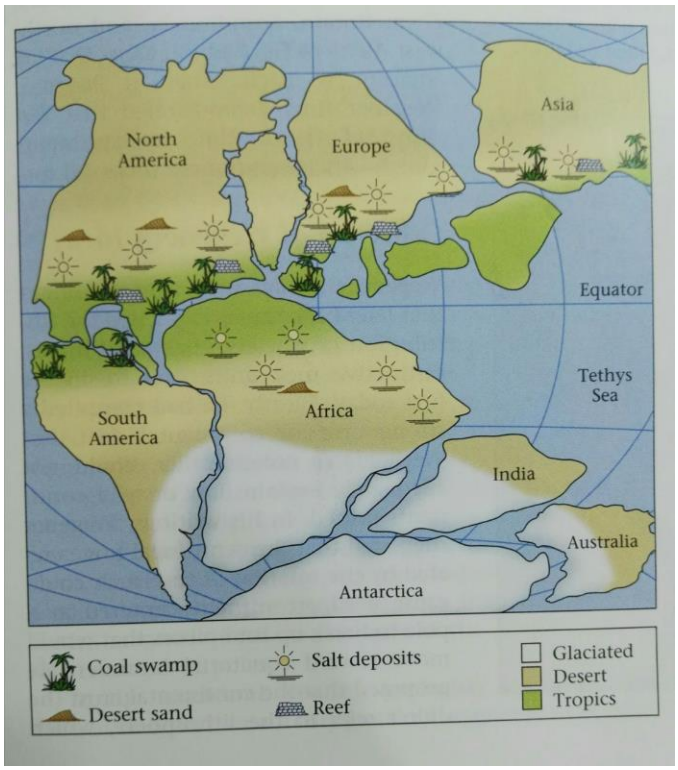

Fig. 3 Map of Pangaea, showing the distribution of coal deposits and reefs (indicating tropical environments), and sand dune deposits and salt deposits (indicating subtropical environments). Note how deposits now on different continents.

The distribution of fossils

Wegener plotted locations of fossils of land – dwelling species that lived during the late Paleozoic and early Mesozoic Eras, who found that they had indeed existed on several continents Fig. 4. For example, an early Mesozoic land – dwelling reptile called *Cynognathus* lived in both southern South America and southern Africa. Thus, Wegener argued, the distribution of these species required the continents to have been adjacent to one another in the late Paleozoic and early Mesozoic ears.

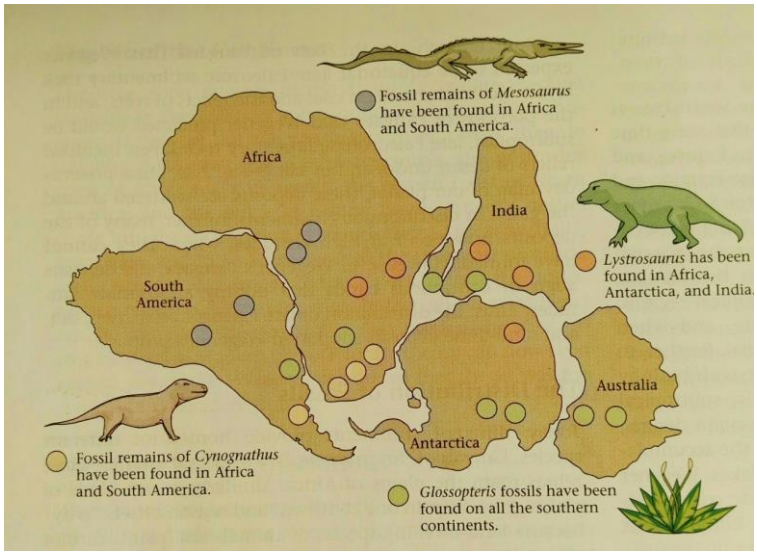

Fig. 4. The map shows the distribution of terrestrial (land – based) fossil species. Note that creatures like *Lystrosaurus* could not have swum across the Atlantic to reach Africa.

Matching geological units

Wegener found that the same distinctive Precambrian rock assemblages occurred in the east cost of South America and the west coast of Africa, regions now separated by Atlantic Fig. 5. If the continents were joined to create Pangaea in the past, then these matching rock groups would have been adjacent to one another, and thus could have composed continuous blocks.

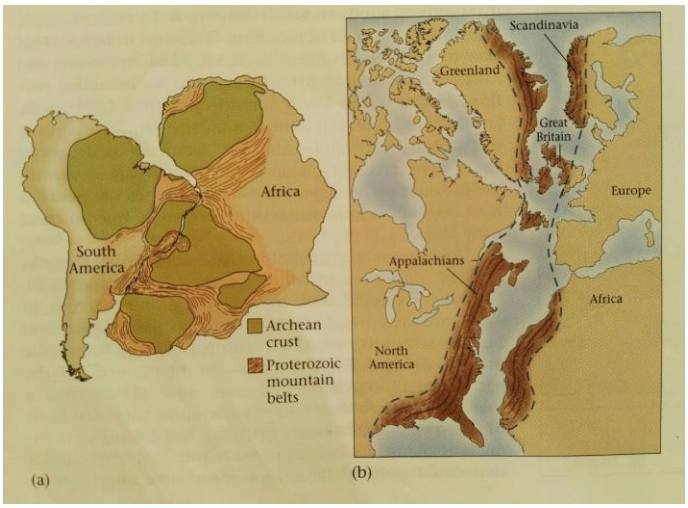

Fig. 5. Distinctive areas of rock units on South America link with those on Africa as if they were once connected and layer broke apart.

Finally, Wegener had made that favored continental drift, he failed to convince his audience because he could not explain how and why continents drifted. He suggested that the centrifugal force created by rotation of the earth could causes a supercontinent centered at a pole to break up into pieces that would move toward equatorial latitudes. The centrifugal force is much less than the force that continents need to move.

The reference

Stephen, M., (2004) Essentials of geology, first edition, printed in United State of America, P 536.