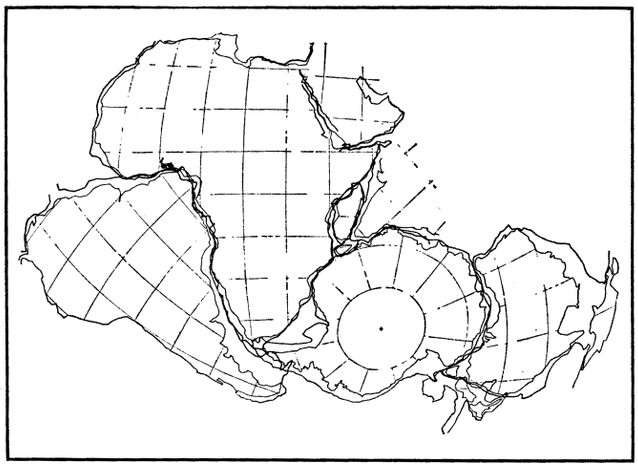

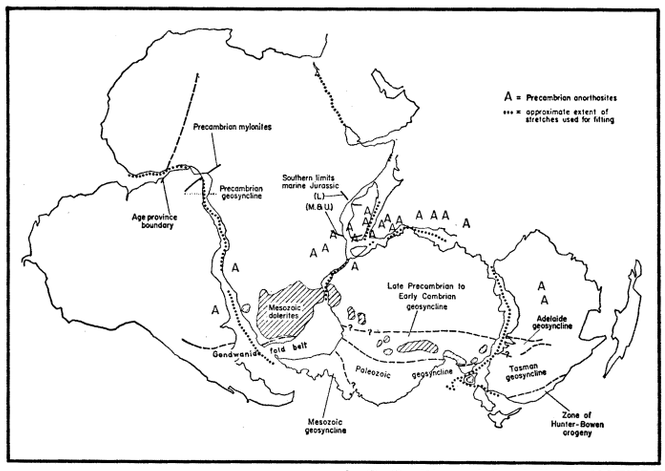

A. G. Smith and A. Hallam; NATURE

Computer outputs and a variety of geological features help scientists to reconstruct Gondwanaland.

GONDWANALAND

The South united

A computer fit of the southern continents is supported by geological evidence

by Kendrick Frazier

Long before continental drift became a generally accepted concept, a few rebels in the field of geology had shown how the continents could be fitted together like the pieces of a puzzle.

Their views conflicted with scientific dogma that regarded the continents as permanently fixed entities. The close geometrical fits, based largely on rough inspection, were attributed to coincidence. Few persons, for example, seriously believed the southern continents once formed a continuous land mass, Gondwanaland.

Today findings from geophysics, geology, paleontology (SN: 12/13, p. 549) and deep-sea drilling (SN: 11/1, p. 394) have convinced all but the most die-hard skeptics of the former existence of Gondwanaland. In recent years earth scientists have been making use of computers to show accurately how portions of Gondwanaland most likely had fit together. In 1965 the English geophysicist Sir Edward Bullard and two colleagues published the currently accepted fit for Africa and South America. Last year two geologists from the Environmental Science Services Administration, Walter P. Sproll and Dr. Robert S. Dietz, announced their determination of the fit between Australia and Antarctica (SN: 5/10, p. 454).

Two British geologists have now provided a view of what nearly all of Gondwanaland must have looked like. Drs. A. Gilbert Smith of the Sedgwick Museum in Cambridge and Anthony Hallam of the University of Oxford published in the Jan. 10 NATURE a computer fit of most parts of the southern continents.

Their reconstruction is based not only on the geometry of the present continents but also on their geological and geophysical characteristics. In fact many other equally good geometrical reconstructions could probably have been made, they say, but they investigated only configurations that were geologically plausible.

The geometrical problem they faced was to bring South America, Africa, Arabia, Australia, Antarctica, India, Madagascar and New Zealand together to form a continuous continental area.

They fitted southeast India to a similar piece of Antarctica. India-Antarctica was placed against a similarly shaped piece of Africa, and the fit was adjusted until India just touched Africa-Arabia. Madagascar was attached to the appropriate part of southwest India.

There were several unresolved problems. Although the Red Sea was closed, for example, several uncertainties led them to leave open the Gulf of Aden to avoid having to make a small rotation of East Africa.

The map is the most complete picture available of the giant continent. "I think it is a reasonable first approximation of what Gondwanaland looked like," says Dr. Smith. "It's certainly not the last word—it is quite possible that some of the details may change in the future—but I think it is the best we have right now."

The geological support for their reconstruction comes from more than a dozen studies, most of them published in the last four years. An ancient shield region in West Africa, for example, continues into northeastern Brazil. A thick Precambrian sequence in Brazil extends into central Gabon. Deposits on Madagascar show relationships to others in Tanzania and southern India.

The geology of West Antarctica is strikingly similar to that of Australia. The history of the sediment-filled trough or geosyncline associated with the Transantarctic mountain range is essentially identical with that of a similar north-trending feature in Australia. Another Antarctic feature continues into South America. Certain rocks on Tasmania and in South Africa known as dolerites are virtually identical in age and geochemistry with others in Antarctica's Victoria Land.

"What we think our map will do is stimulate research in the critical areas where more geological information is needed," says Dr. Smith. "If we can get more data in those areas, such as in the northwestern Indian Ocean and around New Zealand, we can get a better fit. But now nobody has that data."

The irony is that their reconstruction most closely resembles one published by the South African geologist A. L. Du Toit in his book "Our Wandering Continents" in 1937 when much of the geological and geophysical evidence supporting the Smith-Hallam fit was unknown. "Based as they were on limited data," say Drs. Smith and Hallam, "[Du Toit's conclusions] appear to us as a triumph of imaginative synthesis." □