EVOLUTION

Continental drift and the diversity of species

The concept of continental drift has been invoked to explain many different geological events and features—earthquakes, mountains, island chains and deep rifts in the ocean floor.

Dr. James W. Valentine, a specialist in paleozoogeography at the University of California at Davis, believes that the movements of continental plates in the past may also have regulated the ebb and flow of life.

While studying theoretical aspects of the diversity of species, Dr. Valentine said at the annual meeting of the Geological Society of America last week in Milwaukee, he began to notice certain patterns. One was that the diversity of marine shelf biota seems to depend on the stability of food resources. Where such resources fluctuate in abundance and nature, marine shelf animals must be very flexible. They must be able to eat a wide variety of foods, survive in many different environments and reproduce rapidly. Only a few species are normally found in such areas.

On the other hand, he says, where food resources are stable, animal populations can become very specialized, and many species flourish.

The prime factors determining food supply, according to Dr. Valentine's theory, are solar energy and fluctuations in nutrient supply. Solar radiation, of course, varies with latitude. High latitudes, with drastic seasonal changes, have large variations in food supply and small diversity of species. In lower latitudes, the opposite is true.

Longitudinally, he says, the major factor determining food supply is nutrient flow, which in turn depends on the arrangement of continents and oceans. The greatest fluctuation in food supply and least diversity in marine shelf populations, says Dr. Valentine, occurs along large continents facing small oceans, as in the Arctic. The least fluctuation and greatest diversity occurs along small continents washed by large oceans, as in Antarctica.

In addition, since the continent's size determines the influence the seas will have in moderating its climate, large continents would have greater seasonality and less diversity.

Plate tectonic processes, causing alternate fragmentation and reassembly of continents and movement of the land masses across the globe, says Dr. Valentine, have drastically affected marine shelf life.

As continents break apart, he explains, the size of the land masses in relation to surrounding ocean—decreases and diversity of life forms increases. Each continent develops its own biota, and as the continents drift apart, latitudinal variations also increase. Most species have a small latitudinal range, Dr. Valentine points out, so considerable replacement of species along a north-south coast would occur. Conversely, as continents reassemble to form supercontinents, constancy of food supply and diversity decrease.

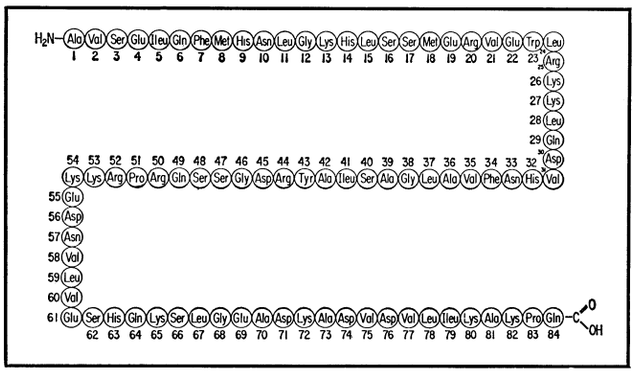
Dr. Valentine has charted the number of families of marine shelf animals against geological time. The resulting curve shows a period of high diversity 400 million to 500 million years ago in the Middle Paleozoic (Ordovician, Silurian, Devonian), when Pangaea I was breaking up (see p. 392). The curve plummets in the Carboniferous, when continents reassembled to form the second supercontinent, Pangaea II. As the second Pangaea broke up into the present continents and these continents began to drift apart, the diversity curve shoots up again, far surpassing any of the previous peaks.

The present great variety of species, says Dr. Valentine, can be attributed to a favorable arrangement of continents. Not only are there many continents spread over all latitudes, but many long continental margins, such as those of Africa and North and South America, are aligned in a north-south direction, maximizing latitudinal variation along a given continental shelf.

Plate tectonics, Dr. Valentine concludes, provides a whole new framework for the study of past life forms. "One might say," he remarks, "that global tectonics has become the handmaiden of paleontology." □

DISPUTE OVER DISCOVERY

Parathyroid stimulates discussion



Parathyroid hormone: The sequence of its 84 amino-acid molecules revealed for the first time.

Dr. Brewer

The meeting was going well; by all accounts, better than most. The topic was cyclic AMP, a chemical which mediates the activity of most, if not all, of the body's hormones. In the five years since its discovery, cyclic AMP has emerged as one of the more exciting and fashionable subjects of biological research (SN: 11/14, p. 382), and a symposium sponsored by the New York Academy of Sciences last week drew more than 400 eager investigators who jammed into a ballroom at the Waldorf Astoria to hear leading researchers present their latest data.

But while the majority of the presentations duly earned the approbations of the sophisticated audience, it was not until late in the afternoon of the second day that anyone said anything to generate real excitement. It was then, at the tailend of a discourse on the role of cyclic AMP in mediating the activity of parathyroid hormone, that Dr. Gerald Aurbach of the National Institutes of Health in Bethesda, Md., went on to announce that, in collaboration with a research team from the Massachusetts General Hospital, the structure of parathyroid hormone had been determined, and part of it had been synthesized. His declaration sent the room buzzing, and scientists who had been chatting in the lobby rushed back to the meeting room to hear the news.

Parathyroid hormone plays a number of roles in the body, its principal function being the regulation of levels of calcium in blood. Hence, parathyroid hormone disorders are implicated in metabolic bone disease, as well as muscle and nerve disturbances. Knowing its structure—the correct sequence of amino acids of which it is constructed—will aid detailed studies of its interactions with other biological compounds. Experiments with a synthetic version of PTH, whose biological activity was confirmed by Dr. Aurbach, will allow investigators to examine its behavior in ways hitherto impossible. Though neither of these new advances in PTH research is of sufficient magnitude to make the evening news, their significance was not underestimated by those scientists who heard Dr. Aurbach speak.

There was, however, one flaw in an

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