# What's a reef doing in a place like this?

Within an hour after discovering the fossilized remains of a coral reef in the Wallowa Mountains in Oregon, two paleontologists decided that the reef could just as well have been in the Austrian and German Alps. The rock forms and fossils entombed in the Oregon reef were nearly identical to the reef formations in the European mountain chain. "As far as we're able to determine now, almost everything [in the Oregon reef] including the algae has counterparts over in the Alps," says George D. Stanley Jr. at the University of Montana in Missoula.

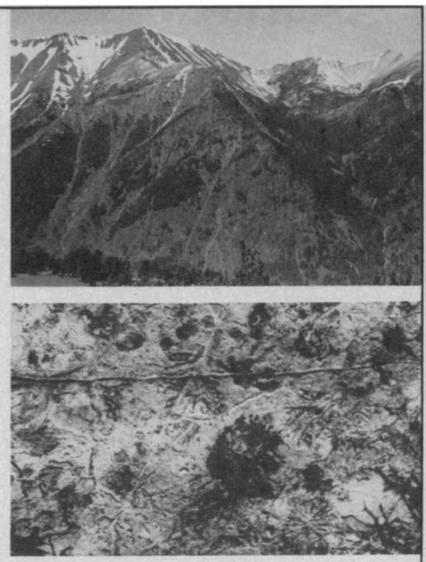
Now Stanley and Baba Senowbari-Daryan of Erlangen University in West Germany are faced with the problem of how the Oregon reef – the first known coral reef of Triassic age (about 220 million years old) found in North America – came to be.

Roxanne Jumer

*One theory of how corals and other sea life might have arrived in North America: All aboard the "island boats" become inhabitants of suspect terrains.*

While the reef is in North America today, it's unlikely that it originated there, in part because the magnetic signature of the underlying volcanic rocks indicates that they formed at a much more southerly latitude. Sections of the Wallowa Mountains are thought to be parts of "suspect" or "displaced" terrains – the 100 or so chunks of crust that have been grafted onto western North America in the last 200 million years as a result of plate tectonics. Over the last decade scientists have come to realize that when continents break up and crustal plates collide, the process is far from neat; slivers of continents and pieces of oceanic crust – from volcanic islands to ocean ridges – become plastered onto other continents, making a mosaic of lands that are alien to their surroundings.

One of Stanley's theories is that the Oregon reef originally formed much closer to the Alpine reefs. The Alpine reefs are thought to have grown along the banks of a dead-end seaway called the Tethys – which extended from the present east coast of Japan across Asia and into the Alps region – before it closed up to form the Alps. The coral reef now in Oregon might once have capped volcanic islands that formed close to Tethys in an ancestral ocean of the Pacific. But in the course of 220 million years the islands, anchored to the spreading seafloor, moved eastward toward the North American continent, eventually merging into it, according to the theory. Stanley also suspects that by the time they reached North America, the coral reefs had been drowned and killed.



Stanley

Stanley

*One of the 20 coral species found in Wallowa Mountains, Oregon (top) – all identical to species found in the Alps.*

Another possibility, says Stanley, is that the mobile larvae of the corals, sponges and other reef organisms moved across the ancestral Pacific by "island hopping," swimming from island to island along a chain of islands. A report of the researchers' findings will appear in an upcoming issue of PALAIOS, a new journal of the Society of Economic Paleontologists and Mineralogists. – *S. Weisburd*

# Quanta at large: 101 things to do with Schrödinger's cat

Is a zebra a white animal with black stripes or a black animal with white stripes? Either-or? Neither-nor? Both-and? Sometimes-one-sometimes-the-other? This question might be an illustration (analogy, metaphor?) of what a macroscopic superposition of states could be.

Superposition of states used to be confined to the microscopic world of quantum mechanics. In the microcosm, objects have a characteristic duality of nature, a mysterious union of opposites for which Niels Bohr adopted the word "complementarity." As long as it was safely quarantined where we couldn't really see it, we weren't really afraid of it. Now it is breaking loose into the macroscopic world of our ordinary perceptions, and physicists are concerned for the future of classical physics and for our ordinary ideas of what's what.

"Do we really think there's a possibility of seeing quantum mechanical effects on a macroscopic scale?" asked Anthony J. Leggett of the University of Illinois at Urbana-Champaign during the recent conference on New Techniques and Ideas in Quantum Measurement Theory, held in New York City under the sponsorship of the New York Academy of Sciences. "Can you see a pure quantum state in a macroscopic system?" asked Sean Washburn of the IBM Thomas J. Watson Research Center in Yorktown Heights, N.Y.

The questions are rhetorical. Leggett and Washburn told how to do it. Claudia Tesche, also of the IBM Watson Research Center, described a "system to undergo macroscopic quantum oscillations." Helmut Rauch of the Atomic Institute of the Austrian Universities in Vienna declared that experiments involving wave-like interference effects of neutrons are testing quantum mechanical properties on a macroscopic scale. Leggett's opening remark could sum up the discussion: "The quantum measurement paradox [in which these questions of superposition and duality play a prominent role] is no longer a matter of 'theology.' It has become an experimental subject."

With recent improvements in experimental techniques, physicists are beginning to do experiments that for 50 or 60 years they could only dream about (SN: 1/11/86, p. 28; 2/1/86, p. 70). These thought experiments, or "gedankenexperiments," as physicists tend to call them, were originally devised to illustrate principles or make a point in an argument, not with the expectation that anyone could actually carry them out. In the words of Anton Zeilinger of the Atomic Institute of the Austrian Universities, physicists are now learning "how to ungedanken gedankenexperiments."

This could prove something of a shock to physics and philosophy. For decades there has been a great gulf fixed between the microcosm, where the ambiguities and uncertainties of quantum mechanics prevail, and the macrocosm, where common sense and the classical physics derived from our bodily senses dominate. A school of physicists usually named for

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