3.5 million years, while basalts at Marsili Basin weren't formed until about 1.9 million years ago at the earliest.

The apparent movement of the seafloor spreading site gives some indication of the way basins like the Tyrrhenian evolve. Such basins are generally nestled behind volcanic arcs, on the overriding plate of a subduction zone. It has been suggested that such basins have evolved toward the subduction zone; "We were able to verify that" pattern in the Tyrrhenian, Kastens says. — *L. Davis*

Shining a light on root canals

Does the dentist's drill frighten you? How about a laser beam in your mouth? Lasers may prove to be a valuable and safe tool in root canal therapy, say University of Alberta researchers.

In a standard root canal procedure, the nerve-containing pulp in the center of the tooth is scraped out and replaced with a rubbery material. But sometimes the small opening at the base of the tooth where the nerve exits isn't completely sealed off and acid-producing bacteria congregate in the area. The acid can cause an abscess by eating away at the surrounding bone and soft tissue, triggering painful inflammation.

Enter the laser. Experimenting on extracted human teeth, the Edmonton researchers have used high-power carbon dioxide lasers to fuse enamel plugs at the base of the root, and have also found that short bursts of laser energy, raising the surface temperature to 1,100° C, can sterilize and glaze the walls of the reamed-out canal. The researchers reported on their work last week at the American Association for Dental Research meeting in Washington, D.C.

A crucial step in developing the process for use in actual patients is to develop a small laser generator and a beam-directing device that can fit in the mouth. The Canadian team has recently developed and begun testing a system that uses a mirror to guide the beam into a small handpiece, and a generator that fits in two small suitcases.

They expect that the process, still several years from human use, will be safe. "In my opinion, it won't be any more dangerous than a scalpel," says Douglas N. Dederich, a dentist and engineer working on the project.

If an abscess hasn't already formed and the tooth is not yet badly infected, a properly done conventional root canal is painless, says Kenneth Zakaraisen, another of the researchers. The laser won't change that situation, he says, but it may be better able to prevent the recurrence of an abscess. — *J. Silberner*

Signs of El Niño and climate upheaval

Three years ago, climate patterns over the world were rudely altered by this century's largest El Niño — a warming of eastern Pacific waters that occurs irregularly every three or so years and lasts 18 to 24 months. The last El Niño doused Ecuador with torrential rains, brought record droughts to Australia and killed much ocean life (SN: 11/5/83, p. 298).

Now a number of researchers report signs of another El Niño in the making, which, if realized, will probably be less severe than the 1982-83 episode. But more than the projected weather system itself, it is one method used in its forecast that has scientists excited. In addition to atmospheric and oceanic measurements, researchers used a new computer model that some say may represent a breakthrough in El Niño forecasting.

According to Eugene M. Rasmusson at the Climate Analysis Center of the National Weather Service in Silver Spring, Md., the present signals of a developing El Niño include warmer-than-normal waters extending from the Peruvian coast north to the equator; sea surface temperatures off Peru were lower than normal in November but during the last three months have risen faster than the usual rate, he says. Equatorial temperatures west of the date line are also higher than normal. And the southern oscillation — an atmospheric pressure "seesaw" between the southeastern Pacific Ocean and the Australian-Indian Ocean region — began in February to swing in a direction consistent with the development of an El Niño.

But partially because one symptom typical of an upcoming El Niño — an increase in the tilt of sea level between the western and eastern sides of the Pacific Ocean — has not occurred, the Climate Analysis Center has put out only an El Niño "advisory," based on current observations, rather than a forecast for the future. Rasmusson says it will probably be another two to four months before he will be able to say anything more definitive.

However, another group of scientists at Lamont-Doherty Geological Observatory in Palisades, N.Y., has made a prediction that an El Niño will strike this year and peak next winter. Mark A. Cane, Stephen E. Zebiak and Sean C. Dolan base their forecast on a simplified version of a coupled ocean-atmosphere model they constructed to study the dynamics of El Niños. Cane's group is the first to use a completely physical model to forecast El Niños; past predictive models have relied on statistical comparisons of El Niño symptoms rather than on their physical causes.

In testing the model for 12 past years, three of them El Niño years, the researchers found that it was remarkably successful in forecasting whether El Niños would occur. They looked at the 18 months preceding the year in question and made six forecasts spaced at three-month intervals. For nine of the 12 years, all six forecasts correctly predicted whether or not there would be an El Niño. For the remaining three years, the forecasts were mixed. For 1986, all six forecasts point to an El Niño, says Zebiak.

"I don't know if this forecast is going to be right or not," comments James J. O'Brien at Florida State University in Tallahassee, "but the work is very good." Adds Rasmusson, "If the first indications of the model's skill stand up, we would be extremely interested" in using it.

Central to the model is the idea that the thickness of the top, warm-water layer in the equatorial Pacific controls the occurrence of El Niños. While this idea is not entirely new, the model shows how critical the warm-water thickness is to El Niño development. Scientists have known that during an El Niño warm waters from the western side of the Pacific move eastward along the equator. Cane and Zebiak argue that during this journey some of the water is also deflected toward the poles, largely by the Coriolis forces of the earth's rotation. The loss of equatorial warm water eventually brings the ocean and atmosphere back to their normal states. The next El Niño cannot be triggered until the lost waters return to the equator, a process that typically takes a few years, say the researchers.

According to Cane, past models have focused on the tilt of the thermocline, the line separating the warm layer from the underlying cold water. In his group's model, the critical parameter is not the tilt but the depth of the thermocline. To make forecasts, the researchers have only to give the computer data on surface winds over the tropical Pacific, which control the thermocline depths.

"We tried to strip down the model to include what we thought were the essential building blocks," says Zebiak. "And the success we've had with it, given the amount of simplification and the poor quality of the wind data, is quite surprising."

Other suggestions of an impending El Niño include a prediction by Paul Handler at the University of Illinois at Urbana-Champaign that the eruption of a Colombia volcano last November will trigger an El Niño this year (see p. 185). And two weeks ago Ralph Schreiber of the Natural History Museum of Los Angeles County, Calif., found a considerable decline in the number and reproductive activity of seabirds living on Christmas Island in the mid-Pacific. Schreiber says he doesn't know if the birds' behavior is predictive of an El Niño, but the same sort of decline preceded the El Niño of 1982. — *S. Weisburd*