staff, communicate with field camps and send data overseas. Staff members at the station were able to consult with colleagues around the world. The importance of and dependence on E-mail at the station became obvious when the modem failed and the station was without E-mail contact for over a month. It was quite a relief when a spare modem was brought to the station to prevent E-mail from vanishing again. As with so many things, you don't appreciate something until it is gone.

The E-mail system at the station continues to evolve. A UNIX server, designed to handle mail more reliably, has just been installed. A more extensive network is currently being installed, providing Internet access to several more computers at the station. Soon the staff will be introduced to the "World Wide Web" (WWW), an information network offering access to libraries, scientific data sets, and news on the latest developments in science from around the world. Not only can this service be used from CDRS to obtain information from around the world but CDRS plans to eventually become a WWW site itself, contributing information about the station, personnel, research projects, and even select data sets. The next time you venture on the "Information Super Highway", keep your eyes open for a giant tortoise, moving slowly but surely forward.

Jim Pinson, Charles Darwin Research Station, Isla Santa Cruz, Galápagos, Ecuador.

FUNDAMENTALS

By: Godfrey Merlen

The eruption on Fernandina Island that occurred toward the end of January 1995 was a spectacular event. For the first time in many years, a large number of people were able to witness a geological "hot spot" in action. The copious quantities of lava that reached the ocean to the west and the interconnecting rivers of fast-flowing molten rock left all who saw it with a powerful image of light and energy. At night, the lurid red clouds painted against the dark sky gave the impression of a penetrating ball of light. Perhaps even Benjamin Morrell would have been impressed by this awesome sight. Unfortunately, pitch is not a chandler's item these days and it was not possible to repeat his observations of 1825!

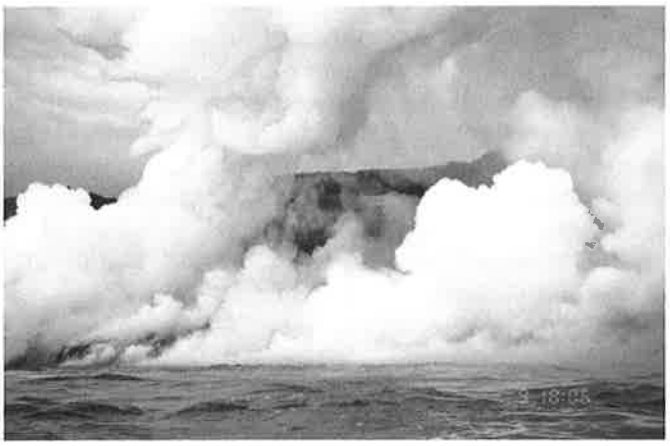
I visited the area on three separate occasions (January 27-30, February 6-7 and March 18-19). I was authorized to land with André Mauchamp on the second trip and with Mitsuaki Iwago and Kiyoshi Yokokawa from NHK (Japanese National Television) on the third trip. I plotted positions of the forming fissures, cones, and lava flows using a portable GPS (Global Positioning System) instrument because observational satellites are out of commission and no aerial photographs of this event will be forthcoming.

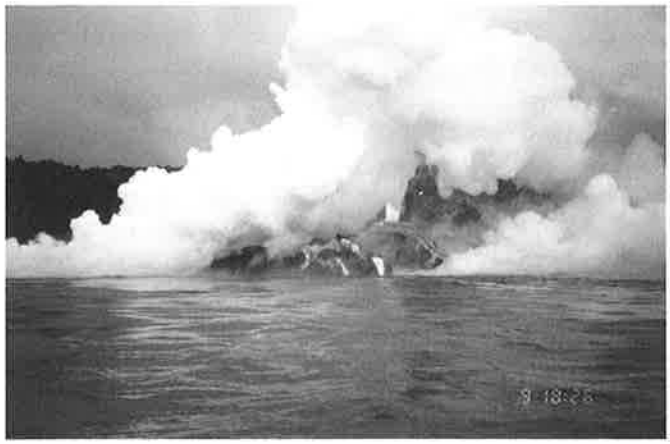
On the night of February 6, while near the source of the eruption, I noticed that a strong flow had developed south of the general pattern of lava channels to the west. This new flow headed with unerring accuracy toward the landing at Cape Hammond. On the morning of the 7th, I crossed a smoky lava field to Iguana Hill, part of an old cone surrounded by new lava, and climbed to its top. The hill is about 1 km from the "source". At the foot of the hill, the flow diverged and huge quantities of molten rock rushed westward in fast-flowing rivers. These rivers occasionally became dammed with enormous, semi-solid boulders the size of houses. On breaking free, the magma surged down steep lava falls with the fluidity of water. Vegetation vanished in spurts of flame and puffs of smoke.

The huge red flows were a striking contrast to the silver-grey palo santo trees on top of the hill, many of which had been felled every-which-way by the initial release of pressure from the eruption. Behind me, the center of the growing source cone displayed a continuous fountain of molten material, falling as scoria hundreds of meters away. By day, the fountain was blood red; by night, a golden arc.

Upon descent, I found that the lava flow had cut off my easy retreat across a large pahoehoe field. Its length was about 4 km, leaving over 1 km between its front and the landing at Cabo Hammond. This front has not advanced, but that day I could see the white-hot interior through cracks between boulders, indicating some movement was still occurring. Several smaller flows have since moved in the same direction between February 6 and March 6, but no more than about 1.5 km from the cone.

Cape Hammond offers a refuge from the swells that continuously batter the coastline from the south. It is the only protected landing between Cape Douglas in the north and Punta Mangle to the east, since wave action has produced vertical cliff faces on the west and south sides of the island. The small bay at the landing is thus a unique feature of this coast and is the result of previous lava flows to the south; an accident of time and place. The bay, with its two boulder beaches and a sandy beach behind a shallow protected pool, is a haven for endemic fur seals, flightless cormorants, marine iguanas, and penguins. Even





Photographs of the Fernandina eruption taken in March 1995 by Susan Noftsker.

though the eruption is a totally natural event, there is human concern for this unique, remote spot behind which the gaping earth is transforming the face of the land irrevocably and irreparably. The same forces that created the Galápagos are now facing the life forms molded by natural selection on these islands. Nonetheless, in these animals I saw no fear of what might be, no collapse into panic or immobility in the face of imminent disaster – reactions which might well have been our own. The fur seal pups leaped and played in their secure pool. The cormorants dried their wings on the small point between the boulder beaches. They were even attempting to breed – one pair now has two eggs in a well-made alga nest. While a smoke pall drifted over the bay, marine iguanas were digging nests in the dark sand beach behind the fur seal pool. Even when the sea temperature in the bay rose to 32°C and the surface turned green, the animals proceeded as if nothing had happened. Life is naïve; perhaps that is why it has survived in spite of the physical dynamics of an often volcanic planet.

On the other hand, thousands of fish died when copious amounts of lava plunged into the water, violently changing the natural rhythm of the sea. Low-frequency, echoing explosions could be heard through hydrophones, miles offshore. The temperature near the coast rose to boiling point. Violent upwellings of cold water, which seemed to be the result of molten lava entering the sea, were juxtaposed with this steaming cauldron. Stresses of pressure, temperature, acoustics, and chemistry exceeded the limits that fish could tolerate. The seabirds took advantage of the mass piscine mortality. Eels, damselfish, scorpionfish, and serranids were eagerly devoured by frigatebirds and pelicans. Some birds were scalded in the process of diving for food. A number of marine iguanas, following their life course too close to the lava flows, were doomed. The coastal alga beds were destroyed. Some iguanas, in the path of the molten lava, reacted to the increasing heat by raising their bodies in their ancient way of cooling themselves. As the heat increased, they tried moving to higher ground, which in some cases meant walking directly onto flowing lava, where the extreme temperatures overwhelmed them.

High up on the flank of the volcano, where the lava pumped forth onto the surface of the island, land iguanas also perished in the confusion. One land iguana had moved onto a new lava slope which was still blisteringly hot when I arrived. The dead animal stood immersed in the lava, with its head strained upward, its tail tightly coiled, and arms stretched to full extent – its extremities had vanished. Cactus plants surrounding the cone were blistered on the side facing the heat; many other species of shrubs appeared dead. The palo santos stood with golden brown leaves, crisped by the earthly furnace.

On my second visit to this highland region (March 18-19), I was able to approach, through the smoke, to the base of the cone. There I found land iguanas crunching over the deep scoria bed and saw, under the black slopes of this new slag heap, an iguana raise itself up while a mockingbird removed parasites from its red-gold legs. I saw the land iguanas tucking in on the new, fresh leaves that were pushing forth from the shrubs that I had previously thought dead. Within a meter of the still hot lava, an *Opuntia* cactus had put forth new pads and flowers. Amidst the tangle of broken palo santo trees torn from the ground, the silver bark split from the brown-gold sapwood beneath, the new volcano in its awesome and beautiful fury showered down scoria, which in a little while will produce new soil. Life on this planet is naïve, but has an opportunism built into it that is capable of dealing with such bizarre situations.

If all that we see happening in this absolutely natural event is acceptable, why should we be concerned for the life at the Cape Hammond landing? In part, it is because of what we have learned of the fragility and vulnerability of Galápagos life. The physical forces that affect the solid part of the planet are unpredictable. Their expression is primitive and awesome and their effects are uncontrollable. The life on these oceanic islands is naïve and helpless when faced with extremes. Perhaps the tortoise population on Fernandina was annihilated by eruptions such as

this one. The same week that I ventured on land at Cape Hammond, I also went ashore at Punta Mangle, a mangrove haven on the southeast corner of Fernandina. Tied to the island was a dinghy with eleven loose goats on it. I rubbed the head of one and she seemed to appreciate it in her innocence. If given a chance, these goats, innocent of impending doom, would at a moment's notice step onto the molten lava flows in order to reach the vegetation.

After the volcano has silenced itself, perhaps black rats will arrive. Perhaps cats. In these days of change, the sapphire-eyed cormorant and the myopic penguin are in their last haven, for all other areas where they live are irreversibly altered. Any loss of their populations seems to jar at our well-being. In their naïveté, they will vanish forever, without regret. Only we fear the future, unable to control the volcanoes of our own minds, which threaten us and confound our capability to defend a dying world.

Godfrey Merlen, Charles Darwin Research Station, Isla Santa Cruz, Galápagos, Ecuador.

[*Editor's Comment: In Noticias 54 the article "Visitors from the West" by Godfrey Merlen incorrectly remarked on the absence of records of the red-shouldered (also known as the red-spot or blue-lined) wrasse* (Stethojulis bandanensis) *from the eastern Pacific. This wrasse, however, has been previously recorded from Cocos Island in the eastern Pacific (Lopez, M.I. and Bussing, W.A. 1982. Rev. Biol. Trop. 30: 5-26; Bussing, W.A. 1985. Rev. Biol. Trop. 33: 81-98). In addition, recent investigations at Clipperton Atoll reveal an abundant population of this species.* S. bandanensis *is also listed in "Fishes of the Tropical Eastern Pacific" by Gerald R. Allen and D. Ross Robertson (Crawford House Press, Bathurst, Australia 1994) as "widespread in the tropical Pacific Ocean from Australia to southern Japan, and eastward to islands of the eastern Pacific, including Isla del Coco, Clipperton Island and the Galápagos, usually associated with coral reefs". Thus far their occurrence in the tropical eastern Pacific is limited to offshore islands. We thank Godfrey Merlen, Jerry Wellington and Gayle Davis-Merlen for providing this correction.*]

RE-IDENTIFICATION OF THREE DOLPHIN SKULLS IN THE MUSEUM OF THE CHARLES DARWIN RESEARCH STATION

By: Daniel M. Palacios

While working for the Whale Conservation Institute in Galápagos between February 1993 and March 1994, I undertook a study documenting the remains of cetaceans that have been found washed ashore on the islands. Some preliminary results are presented here, including the re-identification of three specimens from the reference collection of the Charles Darwin Research Station.

Of the 22+ cetacean species that have been observed in Galápagos waters (Day 1994), 13 are represented by beached specimens collected since William Beebe's expedition in 1923 (Palacios 1995*a*) (Table 1). The remains of a rough-toothed dolphin (*Steno bredanensis*) (Orr 1965), and a ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*) found on Genovesa in 1970 by Tjitte de Vries (Palacios 1995*b*) provide the only evidence that these two species occur in Galápagos. *S. bredanensis* prefers warmer waters than those normally found around Galápagos and *M. ginkgodens* has never been seen alive anywhere.

At least 29 specimens are housed in 8 scientific collections and 19 more are housed in private collections (Palacios 1995*a*). The museum of the Charles Darwin Research Station alone contains a reference collection of at least 22 specimens representing six species (Table 1).

I examined several of the specimens at the Charles Darwin Research Station and found that three skulls (catalogue numbers V-857, V-858 and V-859) collected by J. Webb on 1 April 1975 from the northwest coast of San Cristóbal and labeled as short-beaked common dolphins (*Delphinus delphis*) did not match those typical for that species. Close examination of the ventral side of the rostrum revealed the absence of the two deep lateral grooves running longitudinally on the left and right palatine processes of the maxillaries (also known as the palatal carination) which distinguish the genus *Delphinus* from all other genera of delphinids (Tomilin 1967; Evans 1994). In addition, I counted only 35-41 teeth (or alveoli when teeth were absent) in the upper and lower jaws of these specimens, as opposed to 45-50 teeth (or alveoli) in the jaws of other *D.*