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# EDITORIAL

## Citizen Scientists

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When was it that you first realized that the actions of politicians affect your science, and that your science can be important in policy debate?

For many of AGU's members in the U.S., it was the first time a government program we relied on for support was threatened because of a federal budget cut. Only then did we become acquainted with our elected representatives. Our initial visits often revealed large gaps in their understanding about our particular areas of interest. The intense interest on the part of legislative staff members for more information about our research programs, however, was gratifying. Perhaps they had questions about the science underpinning a local environmental crisis, or the scientific understanding of a recent natural disaster. At this point, we realized that educating policy-makers about our research is a very important thing and is welcomed by them.

Unfortunately, most of us have other priorities, and too often we don't follow through until the next legislative "crisis" occurs.

But follow-through is important. Fundamental scientific research in the Earth and space sciences is funded in the U.S. and worldwide almost exclusively by government. In addition, actions by the U.S. Congress and other national legislative bodies often have strong ramifications on Earth and space sciences research everywhere, because of the existence of so many cooperative international research programs.

In the U.S., many policy issues concerning science arise during Congressional debates over the funding of scientific agencies or the military, or participation in international initiatives, or environmental legislation. Science-related policy issues may also crop up as the result of regulatory actions by executive branch agencies, or reports containing policy recommendations; the latter are often open for comment by interested citizens. Many of these policy issues are crucially important to individual AGU members and their institutions.

As an organization, AGU makes its views known to policy-makers at the international, national, state/provincial, and local levels through its official position statements. However, the value of these statements and their potential influence hinges on the awareness and activity of individual AGU members.

To keep its U.S. members aware of science-related policy issues that come up in Congress, AGU publishes AGU Science and Legislative Alerts (ASLAs)—brief notices to members which advise on when a phone call, letter, fax, or visit to a legislative representative will be most effective.

A critical opportunity for direct meetings with members of Congress is coming. U.S. members are urged to join with colleagues in other scientific disciplines for Congressional Visits Day on May 1–2, 2001. Hundreds of scientists and engineers will gather for a half day of briefings from scientific leaders in the Administration, legislators, and key staff members, and a full day of visits to their elected representatives in Washington, D.C. The goal is to raise the visibility of and support for science, engineering, and technology in Congress.

Congressional Visits Day affords the opportunity to tell the lawmakers for whom you vote why your science is important to the nation.

If you would like to participate, or if you know of someone who would, please contact Peter Folger at AGU headquarters (Tel. 202-777-7509; E-mail: pfolger@agu.org).

**Author**
*James Burch*

# Deep Drilling into a Hawaiian Volcano

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Hawaiian volcanoes are the most comprehensively studied on Earth. Nevertheless, most of the eruptive history of each one is inaccessible because it is buried by younger lava flows or is exposed only below sea level. For those parts of Hawaiian volcanoes above sea level, erosion typically exposes only a few hundred meters of buried lavas (out of a total thickness of up to 10 km or more). Available samples of submarine lavas extend the time intervals of individual volcanoes that can be studied. However, the histories of individual Hawaiian volcanoes during most of their ~1-million-year passages across the zone of melt production are largely unknown.

If stratigraphic sequences of lava flows from Hawaiian or other oceanic volcanoes spanning long time periods could be obtained, they would provide valuable probes of plume structure and magmatic processes. Continuous core drilling through lava sequences on the flanks of oceanic volcanoes is the most direct approach to obtaining such stratigraphic sequences.

The opportunity to probe the long-term history of a Hawaiian volcano by drilling has led an international group of scientists to core-drill into Mauna Kea (MK) volcano on the island of Hawaii. Planning for the Hawaii Scientific Drilling Project (HSDP) began in 1986. The objective of the HSDP is to recover and characterize as nearly a continuous sequence of core samples as possible to a depth of at least 4.5 km.

In the fall of 1993, the National Science Foundation (NSF) supported the core-drilling of a 1.06-km-deep "pilot hole" through a veneer of Mauna Loa (ML) flows into the flank of Mauna Kea volcano in Hilo, Hawaii (Figure 1). Core recovery was ~90%, yielding a time series of fresh subaerial lavas extending back ~400 Ka. Petrological, geochemical, geomagnetic, and volcanological characterization of the recovered core, downhole logging, and fluid sampling provided a view of the evolution and internal structure of a major oceanic volcano that was unavailable from surface exposures. Detailed information on the pilot hole can be found at the HSDP Web site (http://expet.gps.caltech.edu/Hawaii_project.html) and in the May 1996 special issue of *JGR* [*Stolper et al.*, 1996].

Based on the success of the pilot drill hole, the first of two phases of deep drilling began in Hilo on March 15, 1999, at a site ~2 km south

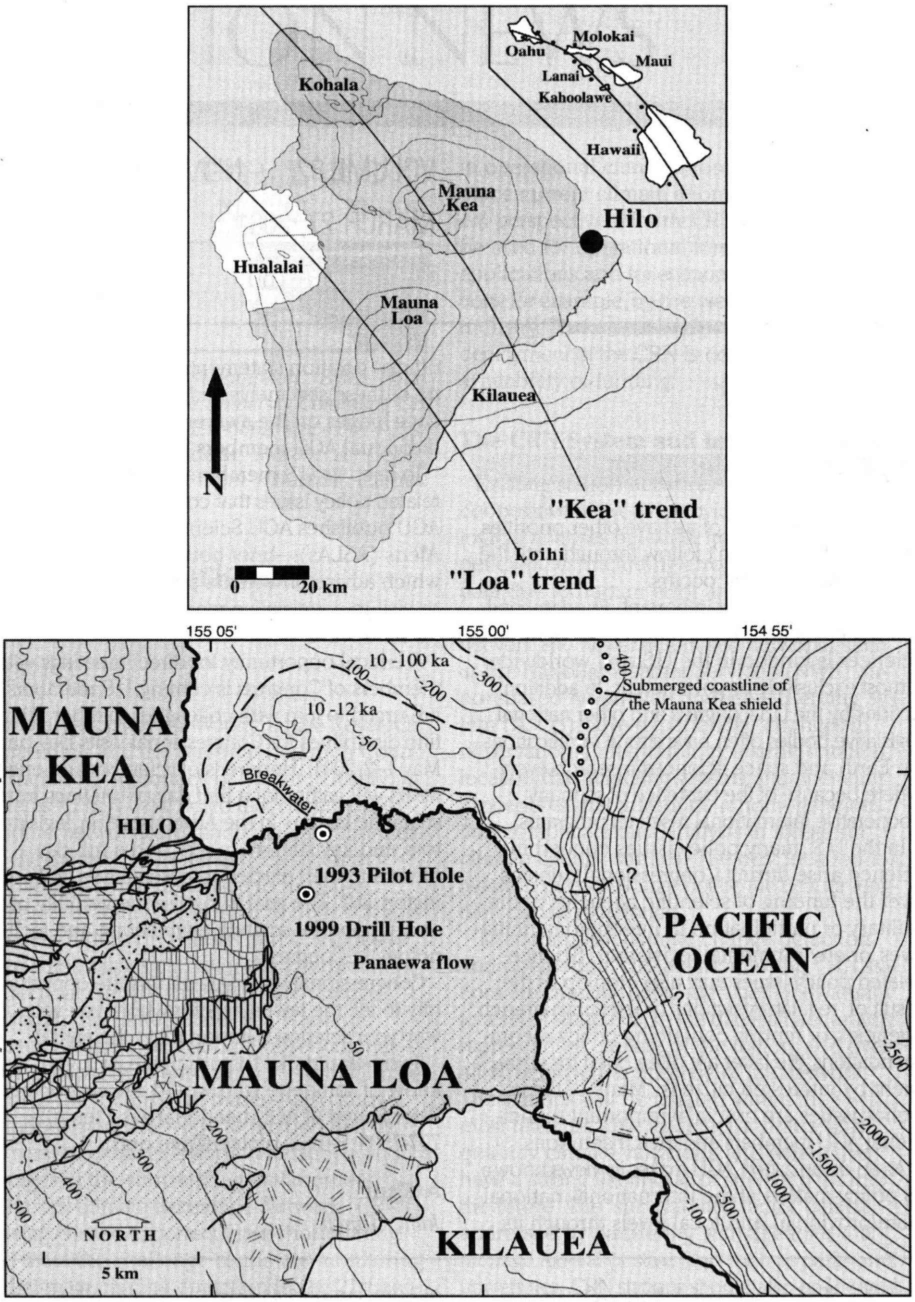


*Fig. 1. Location map for the Hawaii Scientific Drilling Project pilot hole (drilled in 1993) and the first phase of deeper drilling (1999). Original color image appears at the back of this volume.*

of the pilot hole (Figure 1). Supported primarily by the NSF, but with significant support from the International Continental Drilling Program (ICDP) in Potsdam, Germany, this first phase of deep drilling was completed on September 23, 1999 at a depth of 3,098 meters below sea level (mbsl). The objective of this phase of deep drilling (2,440 m) was exceeded by more than 25%, and overall core recovery was ~95%.

In this article, we summarize the drilling experience, aspects of the downhole logging experiments, lithological descriptions of the core, and preliminary geochemical analyses of the core. We conclude with an outline of plans for the next phase of deeper drilling.

## Site Selection, Drilling, Downhole Logging

An abandoned quarry on the grounds of the Hilo International Airport was chosen as the site for the drill hole (Figure 1). As was the case for the pilot hole, the site was chosen (1) to be far from volcanic rift zones, so as to minimize chances of encountering intrusives, alteration, and high-temperature fluids; (2) to be close to the coastline, so as to minimize the thickness of subaerial lavas that would need to be penetrated to reach the older, submarine parts of the MK section; and (3) in an industrial area, to minimize environmental and community impacts.

Although the MK section was the primary target, this choice of site required drilling through a veneer of ML flows, thereby providing additional information on the ML volcanic succession as a complement to the coverage of the MK sequence. The hole design (Figure 2) called for successive periods of coring to pre-determined depths, followed by rotary drilling to open the hole for installation of progressively narrower casing strings.

During the planning process, it became clear that no commercially available system could satisfy both the coring and rotary drilling requirements of the hole design, so a hybrid coring system was fabricated that attached to the mast of a standard rotary rig and enabled the system to core and rotary drill alternately from the same platform. From the start of drilling, the hybrid coring system performed well: core penetration rates averaged more than 48 m/day through the subaerial section, which was about 60% faster than expected based on coring of similar rocks in the pilot hole.

The upper-most portion of the submarine section of the hole (which consisted of poorly consolidated hyaloclastites containing lithic clasts up to several tens of cm in size; Figure 2) proved to be more difficult to core, leading to short bit life and poor core recovery. Progressive induration of the hyaloclastite with depth led to an improvement in both bit performance and core recovery down to the first occurrence of pillow basalts (1.98 kmbsl; Figure 2), with an average core penetration rate of 25 m/day in the ~400 m interval above the first appearance of pillows. The pillow lavas were fractured and generally poorly consolidated; when coupled with the increased "trip times" for core recovery and bit replacement from these greater depths, overall core penetration rates decreased to about 20 m/day.

The hole opening and setting of casing using the rotary rig progressed nearly as well as the coring effort: below the shallow casing string at 0.1 kmbsl depth, the penetration rate down to ~1.8 kmbsl averaged ~46 m/day. The HSDP core hole is almost twice as deep as the next-deepest core hole drilled in Hawaii [*Novak and Evans*, 1991]; hence, the drilling environment, the hydrologic conditions, and the thermal structure are especially interesting.

- During the second hole-opening interval (0.1–0.6 kmbsl), a highly productive artesian aquifer was encountered that produced ~7300 liter/min of fresh water. The existence of such an aquifer was unanticipated and may have practical importance for water resources in Hawaii. Below ~2 kmbsl (i.e., the depth at which pillow lavas were first encountered), additional strongly artesian aquifers were encountered.
- We achieved our objective of avoiding elevated temperatures and corresponding hydrothermal alteration of the basalts (Figure 2). From the surface, borehole temperature decreases with depth to a minimum of ~8°C near 600 mbsl. After a nearly isothermal zone associated with the unconsolidated upper hyaloclastites, temperature then increases slowly with depth to a maximum of about 45°C at the bottom of the hole, where the temperature

gradient is ~20°C/km. The initial decrease in temperature with depth was also observed in the pilot hole and is thought to reflect the influence of sea water infiltrating the volcanic pile [*Thomas et al.*, 1996].

At present, the borehole is accessible down to a depth of 2.8 kmbsl and has been flushed of drilling mud at least to this depth. A fluid sampling and hydrologic monitoring program is underway in the hole that is expected to continue for the next 9 to12 months.

## Description, Preliminary Interpretation of Lithological Column

Onsite activities included hand-specimen petrographic description and photographic documentation of the recovered core. This led to the identification of 345 distinguishable lithological units (e.g., separate flow units, sediments, soils, etc.). A simplified version of the lithological column is shown in Figure 2. Figure 3 summarizes results obtained from the onsite science effort and provides some preliminary results of geochemical analyses.

The core was split longitudinally into a working portion (2/3) to be used for analysis and an archival portion (1/3) to be reserved for future study. A reference suite of samples for geochemical analyses, chosen to be representative and to cover the depth of the core at specified intervals, was taken on site and sent to participating scientists. A key feature of the sampling is that a complete suite of petrological and geochemical analyses is being conducted on this reference suite, allowing for a high level of comparability among complementary chemical and isotopic measurements. All of the data collected on site, including digital photographs of each box containing the working and archival splits, high-resolution scans of the working split, a detailed lithological column, and detailed descriptions of the entire recovered core can be accessed at http://icdp.gfz-potsdam.de/html/hawaii/news.html, a Web site maintained for the project by the ICDP.

*Subaerial Mauna Loa lavas (surface to 246 mbsl).* The lava flows from the surface to 246 mbsl are all subaerial ML tholeiites based on major and trace element analyses. These flows range from aphyric to up to 30% olivine phenocrysts; the average phenocryst abundance is ~11%. Thirty-two flow units with an average thickness of ~8 m were identified in this depth range; *aa* and *pahoehoe* flows are approximately equally abundant. A total thickness of 2–3 m of ash, soil, and sandstone occur interspersed with the ML lavas. The contact between the ML lavas and underlying subaerial MK lavas occurs at 246 mbsl; chemical analyses demonstrate that there is no interfingering of lavas from the two volcanoes. Although the drill site was near that of the pilot hole and the depths of the ML–MK transition (275 mbsl in the pilot hole) are similar at the two sites, the shallow carbonates and beach deposits observed in the pilot hole [*Stolper et al.*, 1996] are not present in the current core. Moreover, although the number of ML flow units identified in the current core is similar to that in the pilot hole (30), there is not a one-to-one correspondence of units in the two cores below the first few near-surface flows.

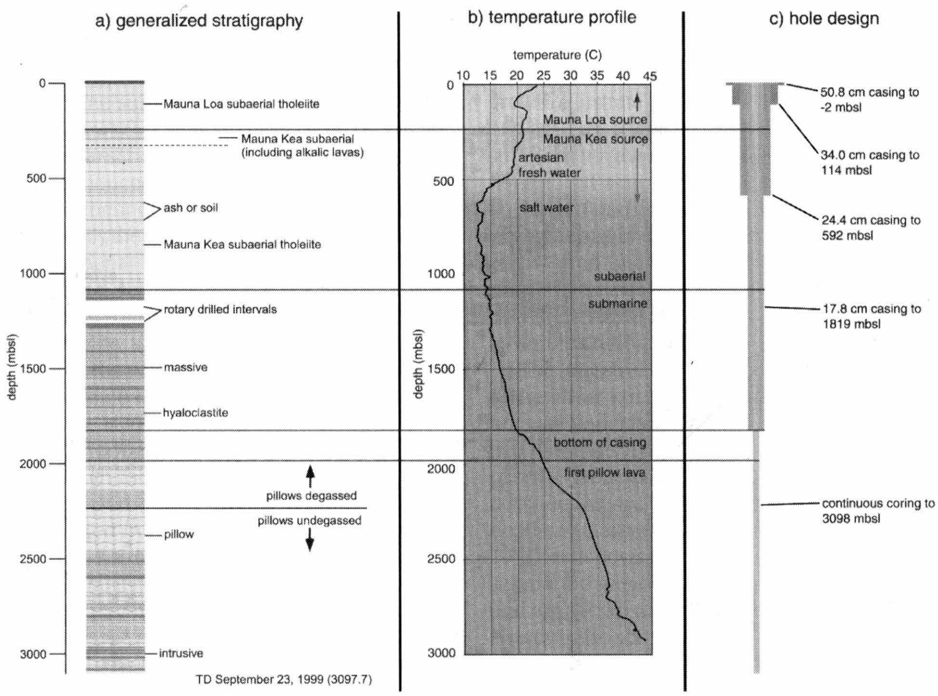


*Fig. 2. Summary of the HSDP core hole: (a) simplified lithological section; (b) T (°C) versus depth; (c) hole design. Original color image appears at the back of this volume.*

*Subaerial Mauna Kea lavas (246 to 1,079 mbsl).* The upper 834 m of the MK section consists primarily of ~120 subaerial flows of 7 m average thickness; ~25% of these flows are pahoehoe. A total thickness of ~2 m of ash and soil occur within and between many flow units. Preliminary chemical analyses demonstrate that the uppermost ~50 m of the MK section contains interbedded nepheline-normative and hypersthene-normative lavas, marking the end of the shield-building phase of MK's volcanic cycle. Deeper subaerial MK lavas are aphyric to up to 35% olivine phenocrysts; the average phenocryst abundance is ~13%.

*Submarine Mauna Kea – dominantly hyaloclastite debris flows (1,079–1,984 mbsl).* An abrupt transition to the submarine part of the MK section occurs at a depth of 1.08 kmbsl, marked by the occurrence of volcaniclastic sediments and glassy lavas significantly denser than those above the transition. Based on radiometric ages of the lavas at the base of the nearby pilot hole, the subaerial-submarine transition has an estimated age of ~400 Ka [*Sharp et al.*, 1996]. The estimated average subsidence rate at the drill site over this interval, ~2.5 mm/y, is similar to the current subsidence rate in Hilo measured by tide gauges, to the average subsidence rate for the past several tens of thousands of years based on sediments in the pilot hole, and to the average values over 100–200 Ka at several near-shore sites around Hawaii based on the ages of drowned coral reefs [*Moore et al.*, 1996].

The upper 60 m of the submarine section (1.08–1.14 kmbsl) is an alternation of massive basalts (2–3 m average thickness) and clastic sediments (~3 m average thickness; dominantly basaltic hyaloclastite), which occur in roughly equal amounts. The vesicularity of the massive basalts in this depth range is variable but mostly lower than the 10–20% typical of the subaerial lavas (Figure 3). When combined with the low water contents of glasses from these basalts (Figure 3), this suggests that these massive basalts are subaerial flows that continued past the shoreline as submarine flows. The hyaloclastites consist of a matrix rich in glassy fragments, plus basaltic lithic clasts from <1 cm up to several tens of cm in size. These clasts are similar lithologically to the massive basaltic units, although they are usually more vesicular. The basalts in this depth range are highly fractured and the hyaloclastites are poorly indurated, leading to the poor drilling conditions described above.

The interval from 1.22–1.98 kmbsl consists of ~90% well-indurated basaltic hyaloclastite, interspersed with ~10% massive submarine basalts. The basalts are divided into 26 units with an average thickness of 3–4 m. They are olivine phyric, and point counts on the hand specimens suggest a systematic decrease in olivine abundance with depth in this interval from 20% at the top to <10% at the bottom (Figure 3). The vesicularity of the massive basalts in this interval is typically <1%. Although some of these massive basalts could be intrusives or large lithic clasts, most have been interpreted as subaerial flows that continued past the shoreline as submarine flows. As at the top of the submarine section, the hyaloclastites in this deeper interval consist of a matrix often rich in fresh glass

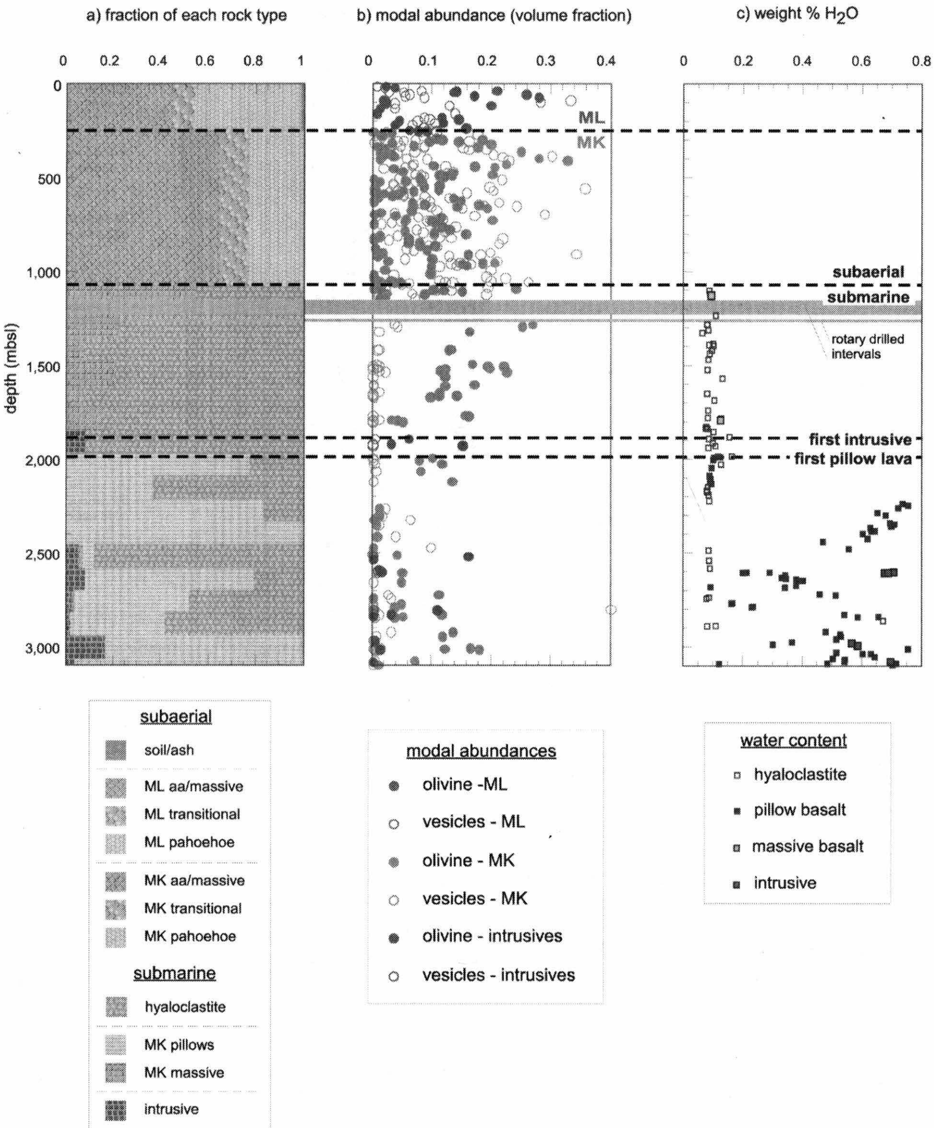


*Fig. 3. Summary of onsite observations and preliminary geochemical data for rocks from the HSDP core hole: (a) relative proportions of rock types versus depth; (b) abundances of phenocrysts and vesicles versus depth; (c) water contents of glasses from the drill core versus depth; volatile contents are roughly bimodal, with the lower values indicative of degassing under subaerial conditions and the higher values indicative of submarine eruption. Note the two intervals of 17 and 83 m rotary drilling through poorly consolidated hyaloclastite; these were the only sections of the hole that were not cored. Original color image appears at the back of this volume.*

fragments, plus variably olivine-phyric, variably vesicular basaltic lithic clasts. In some intervals, where these volcaniclastic sediments are bedded and/or poor in lithic clasts, they are described as sandstones or siltstones.

Preliminary analyses of water contents of glassy fragments in the hyaloclastites demonstrate that they have been degassed subaerially (Figure 3). This, plus the often highly vesicular nature of the basaltic clasts and the presence of charcoal in at least one hyaloclastite suggest that this thick interval of hyaloclastite represents material transported downslope (probably by slumping from over-steepened, near-shore environments) as the shoreline moved outward during the subaerial phase of growth of the Mauna Kea volcano [*Moore and Chadwick*, 1995].

*Submarine Mauna Kea – dominantly pillow lavas (1,984–3,098 mbsl).* From a depth of 1.98 kmbsl to the bottom of the core, the section is ~60% pillow basalts, with less abundant intercalated volcaniclastic sediment. Several thick intervals (up to ~100 m each) composed nearly entirely of sediment are also present. The sediments are primarily hyaloclastite, again probably transported from near-shore environments based on their volatile contents (Figure 3). The pillows typically have fresh glassy margins. They range from aphyric to up to 18% olivine phenocrysts; the average olivine content is ~6%—much lower than the average for the subaerial MK flows (Figure 3). Vesicularities range up to 10%, but the average is 1–2%. Water contents of the glassy pillow margins are ~0.08 wt. % at 1.98–2.14 kmbsl, consistent with subaerial degassing, but most pillow margins from depths 2.2 km have water contents of 0.2–0.8 wt.%.

The water-rich, deeper lavas were never degassed under subaerial conditions and are interpreted as submarine eruptions. The deepest ~180 m of the core contains no hyaloclastite, perhaps suggesting that pillow lavas will dominate the deeper sections of the core. Note that at this point, the assignment of lavas in this depth range to the products of a single volcano (Mauna Kea) has not been confirmed by geochemical analysis.

*Intrusive units.* Intrusive basalts are present in the deepest portions of the core, but they are nowhere abundant. Between their first occurrence at 1.88 kmbsl and the bottom of the core, they make up ~4% of the core. They are most abundant in the 2.5–3.1 kmbsl interval, where they are 7% of the core.

Thirteen such units have been identified, but up to nine splays of a single intrusive unit sometimes occur. They range from aphyric up to 16% olivine phenocrysts (with an average phenocryst content of 4–5%), and their vesicularities are all 1%. The relationship of the intrusives to the lavas and sediments that they intrude will have to be clarified by geochemical analysis and dating. However, the lobate shapes of some of the intrusive contacts with the hyaloclastites suggests that the latter were still soft when they were intruded.

*Alteration and faulting.* Basalts in the subaerial and submarine parts of the section are generally relatively fresh, based on the presence of fresh glass and olivine. Although secondary minerals (e.g., gypsum, zeolites, clays) are common from ~1 kmbsl and deeper, they tend to be localized in vesicles and lining fractures. Olivines are often partially altered and in some of the subaerial lavas, the matrix appears clayey. The overall fresh nature of the rocks is consistent with their generally low vesicularity and the low downhole temperatures (Figures 2 and 3). The hydrology of the drill site may also contribute to this in that less reactive, fresh water is present to great depth. Near the base of the core, there is some suggestion of an increased abundance of secondary minerals and alteration based on hand-specimen descriptions.

An interesting aspect of the alteration is a blue coating on most fragments, starting near the depth of the subaerial-submarine transition that becomes less apparent after several hundred meters. Another distinctive feature is a bright blue-green alteration zone extending up to ~30 cm into hyaloclastites from intrusive contacts. Although striking when the core came out of the ground, it faded and was difficult to distinguish within a few weeks.

No significant fault displacements were observed in the core; but slickensides, though rare, are found throughout the section, demonstrating that at least local relative motions occurred in the section.

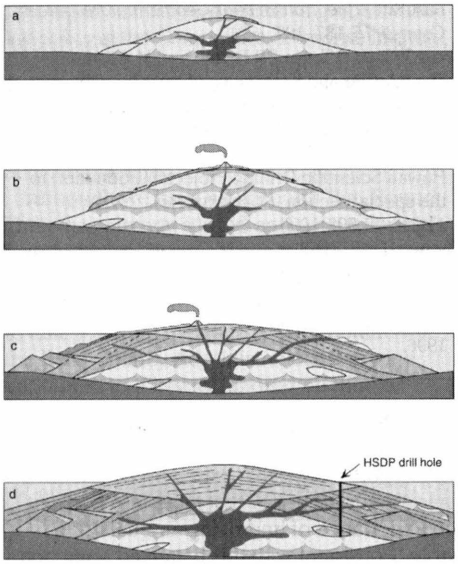


*Fig. 4. Series of illustrations demonstrating the progressive evolution of a Hawaiian volcano and showing the expected sequence of deposits with depth in the hole: (a) submarine/ seamount phase (e.g., Loihi) showing the possibility of submarine landslides; (b) an emergent volcano, showing the eruption of subaerial lavas and the formation of hyaloclastites by slumping of near-shore volcaniclastic sediments; (c) main stage of shield building (e.g., Kilauea), illustrating major landslides, the formation of "massive" submarine units as tube-fed flows extending from subaerial to submarine conditions, the eruption of pillow lavas through the submarine flanks of the volcano, and shallow intrusives into the volcano flanks, including feeders for submarine flank eruptions; (d) after the end of shield-building (e.g., Mauna Kea), showing the near-shore location of the HSDP drill hole. Original color image appears at the back of this volume.*

## Stratigraphy Interpretation in Terms of Evolution

An integrated program of determinations of ages, chemical and isotopic compositions, magnetic and physical properties, and petrography of the recovered samples is underway and will continue over the next year. Our expectation is that the resultant time series will contribute to understanding mantle plumes, the internal structure and evolution of a major oceanic volcano, and related magmatic and volcanic processes. However, even in advance of the detailed characterization of the core that these studies will provide, the onsite characterization of the stratigraphic column and the preliminary geochemical data that are available provide insights into the internal structure and evolution of a Hawaiian volcano.

The idealized stratigraphic sequence expected at a near-shore site such as Hilo, which is located ~17 km south of the east rift of Mauna Kea, can be understood with the progression in the growth of a Hawaiian volcano illustrated schematically in cross-section in Figure 4. Initially, the site accumulates pillow lavas or mass-wasted debris of submarine eruptions (Figure 4a). Once the volcano is big enough to become subaerial, the site accumulates debris flows (i.e., hyaloclastites) from oversteepened, near-shore deposits of glass and lithic clasts produced when subaerial lavas quench and fragment on entering the ocean (Figure 4b). Finally, the shoreline passes over the site, and subaerial lavas accumulate at the drilling site (Figure 4c). Note that the volcano is subsiding continuously as it grows, so subaerial lavas occur below sea level. When the shield-building phase of the volcano's evolution is over, the volcanic edifice continues to subside, and the old shoreline is found offshore, preserved as a break in slope (Figure 4d)

Although the overall stratigraphic section encountered during drilling is similar to that anticipated from the simple sequence shown in Figure 4, it differs from it in several respects:

- The transition from pillow lavas to hyaloclastites might be expected based on Figure 4 to be abrupt, reflecting the unidirectional outward growth of the volcano, yet the actual section has these two rock types interfingered over a depth interval of at least 1 km. Although it is not surprising that the transition from pillows to hyaloclastite is not in fact sharp (reflecting, for example, changes in sea level that will lead to more complex propagation of the shore line, or changes in bathymetry resulting from non-volcanic processes such as landslides, or geometric complexities related to rift zone growth and propagation), the broad transition we have observed was not anticipated.
- Pillow lavas were encountered in the section at a depth much shallower than expected.

Typical slopes of Hawaiian rift zones perpendicular to their axes are ~10–15° [*Fornari*, 1987]. At a distance of 17 km from Mauna Kea's east rift, this suggests a pre-subsidence depth to the pillow lava-to-hyaloclastite transition of 3–4.5 kmbsl. The minimum subsidence is 1 km (i.e., the depth to the subaerial-submarine transition in the drill hole), so based on the simple model illustrated in Figure 4, pillow lavas would not be expected shallower than 4–5.5 kmbsl in the core; yet they first appear at a depth of 2 kmbsl.

There are several possible explanations for the shallow occurrence of pillow lavas in the core, including the following: (1) At the phase of its growth that controlled the stratigraphy of the drill site, the east rift of Mauna Kea could have had a shallow slope of 3–4°. Although this is not the norm, some Hawaiian rifts have slopes this shallow [*Fornari*, 1987], so this cannot be ruled out. (2) The east rift of Mauna Kea may not always have been in its current location. For example, if it was initially further south, closer to the drilling site in Hilo, this could explain the shallower occurrence of pillows, and a complex interfingering of pillows and hyaloclastites might accompany an evolving position of the rift relative to the drill site during movement of the rift toward its current location. (3) Eruption of magma through the hyaloclastites draping the submarine flanks Mauna Kea's east rift could have produced abundant, un-degassed pillow lava much higher up in the section than would be predicted from the simple model of Hawaiian volcano growth illustrated in Figure 4. Support for this explanation comes from studies showing that submarine Hawaiian eruptions are not confined to rift zones [e.g., *Clague et al.*, 2000; *Lockwood and Lipman*, 1987] and from our observations of shallow intrusives penetrating pillows and unconsolidated hyaloclastites, thus possibly representing feeders for such submarine flank extrusives. This possibility is shown as an illustration in Figure 4c.

- The "massive" basalts that make up ~10% of the upper km of the submarine section are not well understood. We have tentatively identified them as subaerial flows that continued past the shoreline and flowed substantial distances in lava tubes (~4 km given their depths and assuming a submarine slope of 10°). Such flows do occur in younger Hawaiian submarine sections [*Garcia and Davis*, 2000] and are shown as an illustration in Figure 4c. However, the absence of pillow structures associated with these units and the rarity of such flows on modern-day Hawaii are problematic.
- The presence of intrusives at relatively shallow depths in the core was not expected, given the distance from the summit and the east rift of Mauna Kea. As suggested above, these units could be feeders for off-rift eruptions, or they could be evidence that Mauna Kea's east rift was previously further south than its current location.

## The Second Phase of Drilling How Deep Can We Go?

The current schedule calls for remobilization of drilling equipment to the site during the last quarter of 2001 to re-enter the hole and continue the drilling program.

The 1999 phase of the deep drilling effort was able to reach a depth that was nearly 650 m deeper than originally envisioned for this phase. As a result, we will be able to start the next phase of drilling by opening the hole to a diameter of 15.9 cm to the current depth of 3.1 kmbsl, and casing will be installed from the surface to that depth. From that depth, we will then core to a maximum depth determined by hole conditions and available funds. Based on the coring conditions encountered near the close of the 1999 phase of drilling, we have a target depth of ~4.5 kmbsl. However, the coring system fabricated for the project is capable of a maximum depth of slightly more than 6.5 km. If drilling conditions and funding allow, this would enable us to approach and perhaps even penetrate the Cretaceous ocean floor beneath Mauna Kea.

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# Bush Reversal of $CO_2$ Pledge Draws Heated Reaction

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Chairing a March 14 hearing of the House of Representatives Science Committee on the science of global warming, U.S. Congressman Sherwood Boehlert (R-N.Y.) commented on President George W. Bush's reversal the previous day of a campaign pledge to regulate carbon dioxide emissions from electric power generating plants.

"I wish the Administration would have waited to hear from experts like the ones before us today," he said, referring to a panel of scientists testifying in the wake of three new reports by the Intergovernmental Panel on Climate Change, "before embarking on what I believe is a misguided and unjustified reversal of positions."

The Bush Administration has defended the reversal as a rational re-examination of the issue in light of what Administration officials call a "national energy crisis." Opponents, however, say the administration has given in to special interests and has undermined Environmental Protection Agency (EPA) Administrator Christine Whitman. Until days before the reversal, Whitman had publicly promoted Bush's campaign pledge to regulate $CO_2$.

## Opposing Bills Introduced

Displaying their disagreement with the reversal, a bipartisan group of senators and members of Congress introduced legislation on March 15 to modernize power plants and reduce their emissions of nitrogen oxides, sulfur dioxide, mercury, and carbon dioxide. In the House, this "four-pollutant bill" is called the Clean Smokestacks Act of 2001; the Senate version is the Clean Power Act of 2001.

Senate co-sponsor Jim Jeffords (R-Vt.) called the Clean Power Act of 2001 "the best opportunity to put an end to smog, acid rain, and, 'code red' summer afternoons. Like many in this nation, I am concerned about our current energy situation. But an energy crisis is not a ticket to pollute. Today's energy emergency should not result in tomorrow's environmental catastrophe."

Jeffords said that power plants account for about two-thirds of the nation's sulfur dioxide emissions, one-third of nitrogen oxides, 40% of carbon dioxide, and one-third of mercury.

Senator Joe Lieberman (D-Conn.), another co-sponsor of the bill, said, "The President and his team have made a 180-degree reversal of their position, suggesting that $CO_2$ is now somehow A-OK. That makes many of us wonder whether the White House was just feeding us hot air about its interest in global warming. But this is about much more than broken campaign promises and political double talk. In this case, turnabout is foul play, and could seriously hurt our efforts to reduce the enormously consequential risks of rising planetary temperatures."

Boehlert, a co-sponsor of the House bill, told *Eos*, "I agree 1000% with the Bush position—the Bush position as articulated on September 29 of last year in his position paper on the national energy policy, in which he said specifically, on page 18 of that document, that gave us all heart, that we have to deal in a responsible way with all four pollutants, not just $NO_X$—nitrogen dioxide—and sulfur dioxide, but mercury and $CO_2$. I agreed with him then, and I hope he will agree with us some time in the future.

"I can't tell you where [Bush's] information is coming from that would lead to a conclusion other than the one we advocate," he continued. "But I am confident that as he puts his team in place and he gets the quality science in the White House that the White House needs—filling the key post of science advisor to the president—he will do what he has done with Secretary [of State] Powell and Secretary [of Defense] Rumsfeld: he will listen to them, and then might have a different conclusion."

## Bush and EPA Administrator Switch Gears

Bush had pledged to regulate $CO_2$ emissions in a September 29, 2000 campaign speech. "We will require all power plants to meet clean air standards in order to reduce emissions of sulfur dioxide, nitrogen oxide, mercury, and carbon dioxide within a reasonable amount of time," he said at the time.

The president announced his reversal in a March 13 letter to several Republican senators, including Chuck Hagel (R-Neb.) and Jesse Helms (R-N.C.).

"I support a comprehensive and balanced national energy policy that takes into account the importance of improving air quality," he wrote. "Consistent with this balanced approach, I intend to work with the Congress on a multi-pollutant strategy to require power plants to reduce emissions of sulfur dioxide, nitrogen oxides, and mercury. Any such strategy would include phasing in reductions over a reasonable period of time, providing regulatory certainty, and offering market-based incentives to help industry meet the targets. I do not believe, however, that the government should impose on power plants mandatory emissions reductions for carbon dioxide, which is not a pollutant under the Clean Air Act."

On March 16, Bush defended his move, saying, "I am concerned that if we don't act in a common-sense way, that our people will not be able to heat and cool their homes. And I'm worried about a failure of an energy policy could affect our economy, and we're dealing with it in a common-sense way."

EPA Administrator Whitman had promoted Bush's campaign pledge as recently as February, when she met with a group of environmental ministers at a Group of Eight (G-8) industrial nations meeting in Trieste, Italy.

Also, during a February 26 interview on Cable Network News, she said that "George Bush was very clear during the course of the campaign that he believed in a multi-pollutant strategy, and that includes $CO_2$, and I have spoken to that... He has also been very clear that the science is good on global warming. It does exist. There is a real problem that we as a world face from global warming and to the extent that introducing $CO_2$ into the discussion is going to have an impact on global warming, that's an important step to take."

Whitman, however, took up a different tone on March 18 when she defended the reversal as necessary in the midst of "a national energy crisis." Bush, she said, "didn't want to do anything that was going to discourage decisions that would result in a better mix of energy [sources]."

In addition to those in the administration who support Bush's new stance, some lobbyists also took some credit for the reversal.

"President Bush and Vice President Cheney have made the right decision on regulating $CO_2$ with a little good advice from their