FALL 2005

GEOL 285:
PETROLOGY

Dr. Helen Lang
Dept. of Geology & Geography
West Virginia University
Hawaiian Volcanism

Part I
Pacific Ocean Floor Topography

Emperor-Hawaiian Chain

bend~40 Ma

Hawaiian Chain
Linear Age/Distance Relation indicates ~constant rate of motion of Pacific Plate over the Hawaiian Hot Spot

8.6 cm/yr
The emergent Hawaiian Islands

younger toward the southeast
Trade winds come from the Northeast

Northeast sides of Islands are lush, green and wet
Exotic vegetation and waterfalls near Hilo, on NE (wet) coast of Hawaii
History of a typical Hawaiian Volcano

1. Initial stage
2a. Shield-building, submarine substage
2b. Shield-building, sealevel substage
2c. Shield-building, subaerial substage
3. Capping stage
4. Erosional stage
5. Renewed volcanism stage
6. Atoll stage
7. Late seamount stage

(Peterson & Moore, 1987, in Volc. in Hawaii, USGS PP 1350)
The Hawaiian Islands

Hawaii, "the big island," shows the earliest stages
Hawaii “The Big Island” in relief

Mauna Kea
13,796 feet

Mauna Loa
13,679 feet

Summits are about 30,000 feet above the seafloor!!
Five Volcanoes make up the ‘Big Island’ of Hawaii

1. Kohala
2. Hualalai
3. Mauna Kea
4. Mauna Loa
5. Kilauea
6. Loihi
Classic Shield Volcanoes, 5-10° slope

Mauna Loa

Mauna Kea
Volcanoes on the “Big Island” illustrate shield building (2a-c) and capping (3) stages.

EXPLANATION:
- Pelagic sediments
- Coral reef
- Lava and tephra of renewed volcanism stage
- Lava and tephra of capping stage
- Tholeiitic pahoehoe and aa, shield-building stage (subaerial substage)
- Tholeiitic pillow lava (submarine substage)
- Alkaline lava, initial stage
- Buried caldera
- Shoreline products (sea-level stage)

Arrows show crustal subsidence; length indicates relative rates.

Very slow subsidence, if any.

Changes of scale:
- Initial stage
- Sea level
- Ocean floor
- Subsidence

Mauna Loa and Kilauea have been most active in the 20\textsuperscript{th} and 21\textsuperscript{st} Centuries.
Kilauea is plastered on the side of much more massive Mauna Loa.
THE CHANGING FACE OF KILAUEA

Kilauea Caldera has undergone dramatic change since the 1823 visit of William Ellia, the first Western explorer. In that year, the caldera was almost 1000 feet deep, twice as deep as it is today. An inner pit, several miles across, contained raging lakes of molten lava. Throughout the 19th century, these lakes repeatedly overflowed, building up the level of the floor halfway to the brim. On 4 occasions this process of construction was suddenly reversed by collapses involving almost the entire caldera floor.

By 1905, Kilauea Caldera looked much as it does today. Since then Halemaʻumaʻu Crater has been enlarged and 7 new flows have been added to the caldera floor. These changes continue to reshape the landscape in dramatic ways.
Kilauea Caldera 1823, 1979
Historic Lava Flows in Kilauea Caldera and Vicinity
Crater Rim Drive, Kilauea, Hawaii
Volcanoes National Park
Kilauea Caldera from the air
Halemaumau Crater inside larger Kilauea Caldera

Lava lake last filled in 1974 (minor 1982),
Note sulfurous steam and deposits
Crater Rim Drive, Kilauea, Hawaii
Volcanoes National Park

Kilauea Iki
Pu‘u Pua‘i
Devastation Trail
1959 eruption

Thurston Lava Tube
in 1959 Puʻu Puʻai erupted basaltic pumice (or cinders) nearby Kilauea Iki Crater collapsed
Thurston Lava Tube