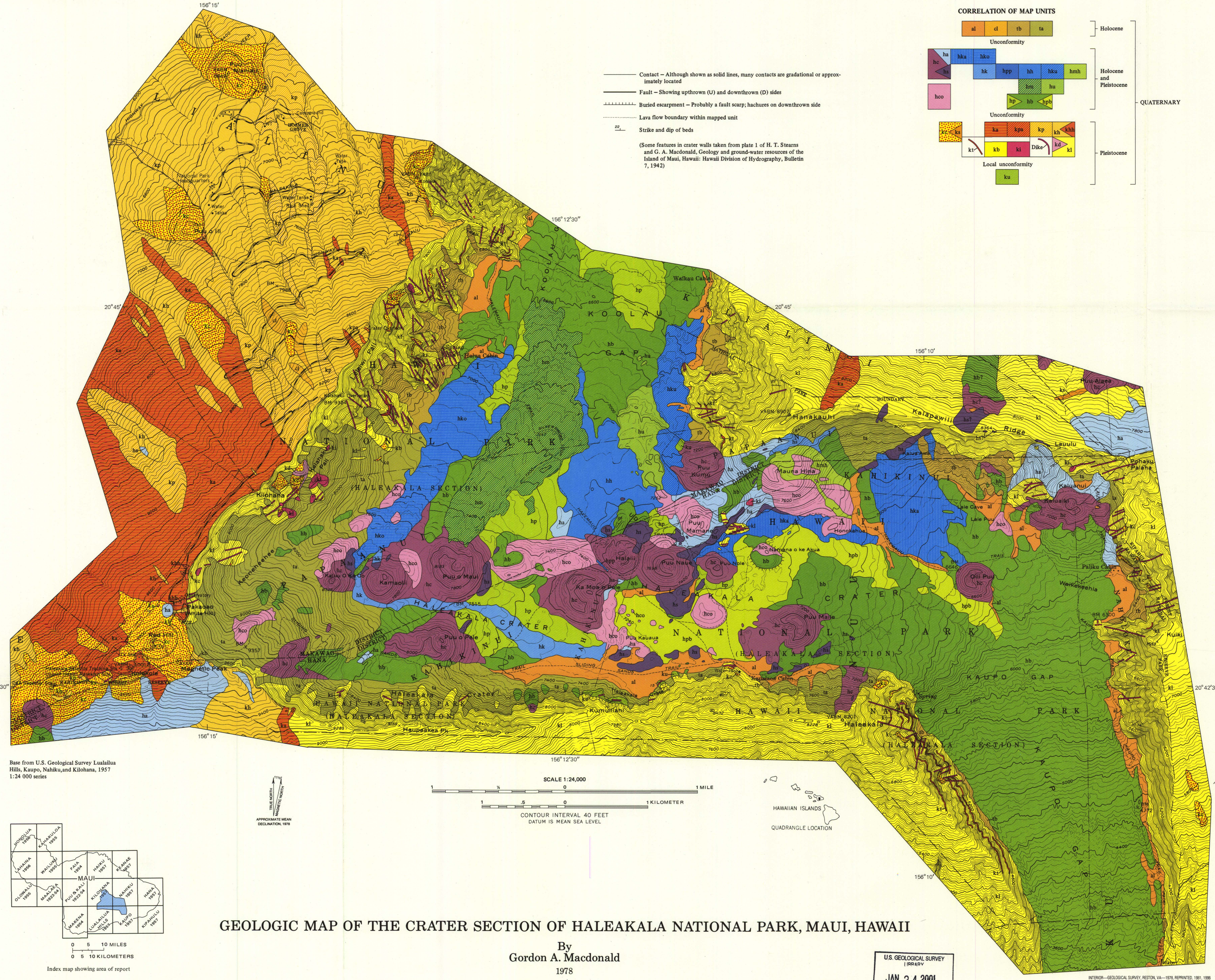
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I-1088



Contact – Although shown as solid lines, many contacts are gradational or approximately located

Fault – Showing upthrown (U) and downthrown (D) sides

Buried escarpment – Probably a fault scarp; hachures on downthrown side

Lava flow boundary within mapped unit

Strike and dip of beds

(Some features in crater walls taken from plate 1 of H. T. Stearns and G. A. Macdonald, Geology and ground-water resources of the Island of Maui, Hawaii: Hawaii Division of Hydrography, Bulletin 7, 1942)

CORRELATION OF MAP UNITS

al, cl, tb, ta — Holocene

Unconformity

hc, ha, hs, hka, hko, hk, hpp, hh, hku, hmh, hco, hm, hu, hp, hb, hpb — Holocene and Pleistocene

Unconformity

kc, ks, ka, kpa, kp, kh, khh, kt, kb, ki, Dike, kd, kl — Pleistocene

Local unconformity

ku

QUATERNARY

Base from U.S. Geological Survey Lualailua Hills, Kaupo, Nahiku, and Kilohana, 1957 1:24 000 series

TRUE NORTH
MAGNETIC NORTH
11½°
APPROXIMATE MEAN DECLINATION, 1978

SCALE 1:24,000

1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

HAWAIIAN ISLANDS
QUADRANGLE LOCATION

HONOLUA 1956
KAHAKULOA 1955
LAHAINA 1956
WAILUKU 1955
PAIA 1954
HAIKU 1957
KEANAE 1957
MAUI
OLOWALU 1955
MAALAEA 1923-54
PUU O KALI 1922-54
KILOHANA 1957
NAHIKU 1957
HANA 1957
MAKENA 1954
LUALAILUA HILLS 1957
KAUPO 1957
KIPAHULU 1957
0 5 10 MILES
0 5 10 KILOMETERS

Index map showing area of report

GEOLOGIC MAP OF THE CRATER SECTION OF HALEAKALA NATIONAL PARK, MAUI, HAWAII

By
Gordon A. Macdonald

1978

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1978, REPRINTED, 1981, 1996

Geology mapped 1970 – 75

DESCRIPTION OF MAP UNITS

SEDIMENTARY ROCKS (Holocene)

al — ALLUVIUM – Stream-deposited sand and gravel along stream channels and in alluvial fans, and silt and clay deposited in closed depressions

cl — COLLUVIUM – Poorly sorted sands and gravels deposited by sheet runoff on the upper west flank of Haleakala

tb — TALUS – Long sloping embankments of breccia, poorly sorted and massive to moderately well bedded, formed at the base of cliffs by gravity fall of rock fragments from the cliffs above

ta — TALUS MANTLED WITH ASH AND CINDER

IGNEOUS ROCKS

HANA FORMATION (Pleistocene and Holocene)

hc — Cinder, with some spatter, forming cones and blankets at and near vents; little eroded or weathered and predominantly black to gray, reddened locally; includes all petrographic types mentioned below; in some cones, contains discrete crystals of augite and (or) olivine up to 1 cm long, and in Puu o Maui also crystals of labradorite feldspar as much as 3 cm long and fragments of gabbro up to 6 cm. Grades into ash blankets with increasing distance from vent

ha — Ash, largely wind blown but some water washed; not separated as to age, but primarily fresh and gray to black on the surface; in some places contains numerous discrete crystals of augite and (or) olivine

hs — Spatter, with some cinder, at vents; not separated as to age

hka — Alkali olivine basalt lava flows from Kalua Awa and vents northeast of Puu Naue, probably the youngest flows in the crater; dark to medium-gray, and aphyric to moderately porphyritic with phenocrysts of olivine and augite up to about 3 mm long; predominantly aa, but some pahoehoe

hko — Alkali olivine basalt lava flow from a vent at the northeast base of Ka Luu o ka Oo; very young (possibly as young as, or even younger than hka); dark gray aa, aphyric in hand specimen but with many microphenocrysts of olivine up to 0.4 mm long

hk — Alkali olivine basalt lava flow from vents at the west base of Kamaolii; dark-gray megascopically aphyric, but under the microscope contains many microphenocrysts of olivine up to 1 mm long but mostly less than 0.3 mm; predominantly aa, with white grains of opal in the vesicles

hpp — Alkali olivine basalt lava flow from Pele's Pig Pen; dark-gray pahoehoe, containing many olivine phenocrysts up to 3 mm long

hh — Porphyritic alkali olivine basalt, approaching picrite basalt; lava flow from vents near the northwest base of Halalii; dark-gray aa containing many phenocrysts of augite up to 5 mm long and olivine up to 2 mm. The southern part of the flow is mantled with ash from Halalii as much as 1 m deep

hku — Alkali olivine basalt lava flow from Puu Kumu; dark-gray aa, with scatter phenocrysts of olivine up to 2 mm long, but mostly less than 1 mm

hmh — Alkali olivine basalt aa lava flow from vents just north of Mauna Hina; dark-gray, aphyric to slightly porphyritic with locally a few phenocrysts of olivine less than 1 mm long. The flow is younger than Mauna Hina

hm — Porphyritic alkali olivine basalt aa lava flow from Puu o Maui, transitional toward picrite basalt; contains abundant phenocrysts of augite up to 8 mm long, olivine up to 4mm, and a few glassy labradorite feldspar up to 2 cm, in a dark-gray matrix; the flow is heavily covered with ash and cinder of the same composition from Puu o Maui, and segments of the cinder cone have been rafted northward on the flow more than 2 km

hu — Dark-gray alkali olivine basalt lava flow from a vent 1.0 km northwest of the summit of Puu Mamane; contains olivine phenocrysts up to 3 mm long but mostly less than 1 mm; the surface of the flow is unusually irregular, with many upheaved areas and protruded spines, and at the vent an upheaved dome-shaped hill covered with spatter

hco — Cinder, with some spatter, forming cones and blankets at and near vents; moderately to much eroded and weathered, predominantly reddish brown to yellowish brown and locally red, probably older than hc. (see discussion of age and correlation of the rocks.)

hp — Porphyritic alkali olivine basalt lava flows, in part transitional to picrite basalt, not separated as to source; dark-gray, mostly aa but some pahoehoe; contain many phenocrysts of augite and olivine up to 5 mm long

hb — Alkali olivine basalt lava flows, not separated as to source; dark-gray, predominantly aa but some pahoehoe, mostly sparsely porphyritic with scattered phenocrysts of olivine up to 1 mm long, but some aphyric, and some with small platy phenocrysts of labradorite feldspar. Rarely, the latter are well alined by flowage and the rock resembles in hand specimen the hawaiites of the Kula Formation (kh)

hpb — Picrite basalt lava flows, not separated as to source; dark-gray aa, containing abundant phenocrysts of augite and olivine up to 8 mm long but mostly less than 4 mm; in some the augite is so predominant that the rock can be termed ankaramite. The lava just northeast of Puu Kauaua is probably the oldest of the Hana Formation exposed in the crater

KULA FORMATION (Pleistocene)

kc — Cones and blankets of cinder, with some spatter, at and near vents; moderately to much eroded and weathered. In some cones, such as Puu Nianiau, there has been much minor gullying, reworking, and redeposition of cinder by running water

ks — Spatter, with some cinder, at vents

ka — Aa lava flows of picrite basalt, including ankaramite; dark-gray, with abundant phenocrysts of augite up to 2 cm long, but mostly less than 1 cm, and olivine up to 5 mm; in the ankaramites augite strongly predominates over olivine

kpa — Composite lava flows consisting of a lower part of porphyritic olivine basalt and an upper part of ankaramite (Macdonald, 1972)

kp — Porphyritic alkali olivine basalt lava flows, in part transitional to picrite basalt; predominantly aa, but some pahoehoe; contain moderately abundant phenocrysts of olivine, commonly also of augite, and a few of labradorite feldspar up to 5mm long, and rarely of magnetite up to about 1 mm

kh — Lava flows of hawaiite, aa transitional to block lava; pale gray to dark-gray, many with marked flowage alignment of platy grains of andesine feldspar giving rise to a sheen on fracture surfaces or a scaly or "schistose" appearance; predominantly aphyric, but with a few phenocrysts of olivine and (or) augite up to 3 mm long and rarely of plagioclase feldspar up to 5 mm; some have vesicles filled with opal; grade into alkali olivine basalt; include a few flows of mugearite, one of which originated at the northwest base of Puu Nianiau, and another of which is exposed on the rim of the crater 1 km northeast of Kalahaku Overlook

khh — Hornblende-bearing hawaiite aa lava flow on southwestern rim of crater; medium-gray, weathering very pale-gray, with many phenocrysts of augite up to 6mm long, olivine up to 2 mm, and acicular hornblende up to 4 mm

kt — Beds of ash and cinder, from about 15 cm to 15 m thick, intercalated with lava flows exposed in the crater walls

Dike — Dike, intrusive into the Kula lavas; most dikes are nearly vertical, from about 10 cm to 15 m thick; include all of the petrographic types listed above, and at least one dike of trachyte, 6 m thick, 0.4 km southwest of the Holua Cabin

kl — Lava flows, not separated as to types but including all the petrographic types listed above, exposed in the crater wall

kd — Volcanic dome of aphyric, dense, medium-gray hawaiite emplaced in the crater of a cinder cone and passing downward into a dike feeder, exposed in the west wall of the crater. Ancient Hawaiians used the rock for adzes

kb — Breccia, probably talus, interbedded with volcanics near the base of the west wall of the crater

ki — Intrusive masses, mainly stocks ("bosses") of medium-gray aphyric olivine-augite microdiorite, with average grain size 0.1 to 0.3 mm, in the west wall of the crater; the irregular intrusive mass 0.65 km northwest of Na Mana o ke Akua consists of fine-grained dense hawaiite

KUMUILIAHI FORMATION (Pleistocene)

ku — Alkali olivine basalt pahoehoe and aa lava flows, thin bedded, commonly with many white phenocrysts of plagioclase feldspar up to 8 mm long, but mostly less than 4 mm, exposed low in the south wall of the crater and in a small knob at the east edge of Koolau Gap

20% TOTAL RECOVERED FIBER

For sale by Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225
Explanatory pamphlet accompanies map

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