Chapter 3

MAUI FIELD TRIP ITINERARY

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INTRODUCTION

The following itinerary constitutes a two-day geological field trip on the island of Maui. One day is devoted to roadside stops viewing accessible features of the three principal volcanic series of West Maui (see Chapter 1 of this section). The second day is devoted to a hiking trip through Haleakala Crater on East Maui. Other stops of geological interest, particularly along the road from Kahului to Kaupo via Kaenae and Hana (East Maui) are accessible by private automobile. Suggested stops along this road are given in Stearns (1942a). Some of the information contained in the following itinerary relies heavily on work by Stearns and Macdonald (1942), Macdonald and Katsura (1964), Macdonald and Powers (1968) and Macdonald (1978). The present state of knowledge of the geology of Maui largely reflects these studies.

West Maui

Field trip stops and geographic localities are shown on Figure 1. The following itinerary utilizes Maui Airport near Kahului (Fig. 1) as a starting point.

Mile 0 - Kahului Airport

From Kahului Airport, follow Route 38 west toward Kahului. Turn right on Route 396 and then merge right onto Route 36 (mile 1.6). Merge left onto Kaahumanu Avenue, Route 32. Take Waihee turn off (north on Route 34, mile 2.8) and proceed 1.2 miles.

Mile 4.0 - Stop 1

Lithified to semi-lithified cross-bedded calcareous dune deposits are exposed in roadcuts along Route 34 between Kahului and Waihee. These eolian deposits lie on alluvial fan deposits and extend inland across the westerly edge of the isthmus. They locally attain a height of 200 ft and extend below sea level (Macdonald and Abbott, 1970). They apparently formed as wind blew sand inland from extensive beaches exposed during a lower stand of the sea (Stearns and Macdonald, 1942).

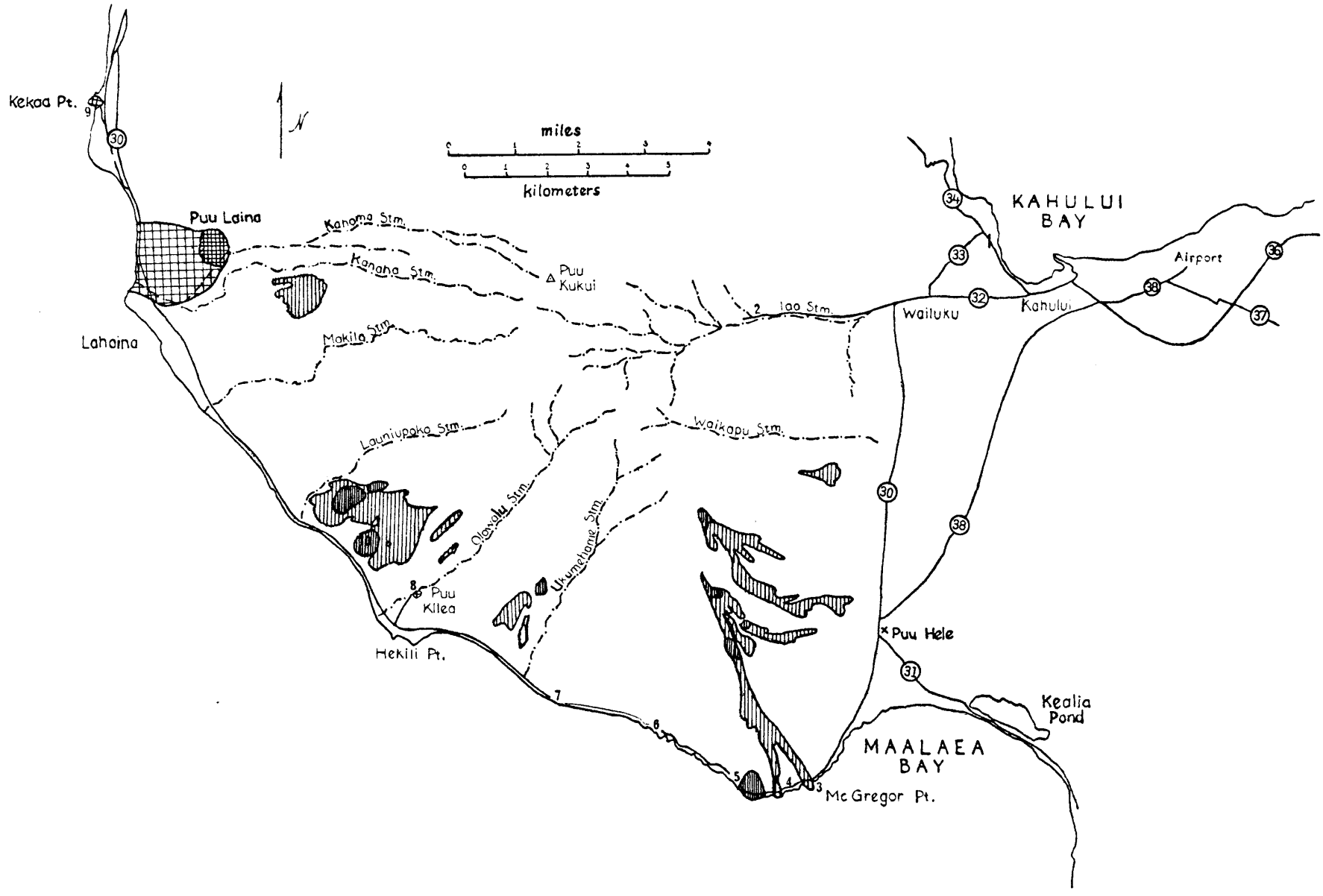

Figure 1. Map of part of west Maui showing field trip stops 1-10. Vertically ruled areas denote Honolua Series cones and flows. Cross-patterned areas are Lahaina Series cones and flows. Honolua and Lahaina series outcrops after Stearns and Macdonald (1942).

Proceed northwest along Route 34, 0.4 miles to the junction with Route 33 (Kahekili Road). Turn north onto Vineyard Street, Route 32 (mile 6.3). Follow the Route 32 signs, which entails a left turn onto High Street and a right turn onto Main Street. There is an early Hawaiian Christian cemetery at the corner of High and Main Streets. Follow Route 32, veering right to Iao Valley at mile 7.1.

Mile 7.3 - weathered conglomerates of Wailuku caldera complex. Further along this road are roadcuts of Wailuku Series lava flows.

Mile 9.0 - Caldera-fill talus breccias with steep dips, plastered onto the ancient caldera walls.

Mile 9.4 - Stop 2

The visitors parking lot is situated near the intersection of Iao Stream and Black Gorge inside the remnant of the old West Maui Caldera. Iao Valley is a spectacular, amphitheater-headed valley that marks the old caldera, enlarged by erosion.

Conglomerates are exposed in the stream below the footbridge leading to the observation shelter. An excellent view of The Needle is obtained from the shelter. Iao Needle is an erosional remnant of Wailuku basalt cut by dikes. A large boss is exposed in the east wall of Black Gorge. It is a coarse-grained, olivine-free alkalic gabbro containing abundant late-stage apatite and alkali feldspar. The discordance between south-dipping talus breccias and northeast dipping lava flows is evident when looking east from the observation shelter. Several dikes are exposed on the south wall of Iao Valley. Abundant native Kukui and Ohia Lehua trees help make Iao Valley a special place for current visitors, as it was for the early Hawaiian residents.

Return east on Route 32, back toward Wailuku. Turn right on Route 30 (High Street, mile 12.4) and proceed to the south along the western edge of the isthmus. Excellent views of Haleakala to the east and the Honolua cinder cones of West Maui on the skyline to the west are available from this road.

Mile 17.4 - Just past the junction of Route 38 with Route 30 is the former site of Puu Hele (Fig. 1) a Lahaina Series cinder cone, now completely quarried away.

Mile 20.3 - Stop 3 - McGregor Point

McGregor Point is composed of a massive flow of alkalic trachytic lava, showing well-developed flow banding. This rock (Anal. 1, Table 1) is very alkali-rich. It's D.I. (Thornton-Tuttle Differentiation Index) is 73.5; Normative An/(An + Ab) = 17.4. Following the classification scheme of Coombs and Wilkinson (1969) it is a trachytic benmoreite. Petrographically it is typical of Hawaiian trachytes with abundant microphenocrysts of olivine, rare magnetite and oligoclase in a trachytic matrix of oligoclase, k-feldspar and magnetite. McDougall (1964) dated a sample from this locality at 1.16 m.y.

Table 1. Lavas of West Maui*

	1	2	3	4	5	6	7
SiO_2	57.97	47.77	46.19	45.30	46.04	61.89	44.07
TiO_2	1.06	3.01	2.15	1.85	2.32	0.51	2.16
Al_2O_3	18.56	14.99	12.02	10.11	12.58	18.15	13.68
Fe_2O_3	1.82	3.07	4.08	3.75	4.51	3.84	4.01
FeO	4.81	10.07	8.19	8.91	8.10	1.03	8.35
MnO	0.24	0.19	0.17	0.18	0.18	0.23	0.20
MgO	1.95	6.05	12.75	17.87	12.22	0.50	11.74
CaO	3.32	10.95	10.43	8.96	10.35	1.33	10.22
Na_2O	6.74	2.48	1.79	1.35	1.98	7.26	3.45
K_2O	2.79	0.50	0.38	0.30	0.42	3.91	1.35
P_2O_5	0.54	0.33	0.20	0.20	0.22	0.13	0.40
H_2O^+	0.18	0.42	1.28	0.76	0.66	0.43	0.38
H_2O^-	0.10	0.39	0.57	0.77	0.74	0.64	0.20
Total	100.08	100.22	100.20	100.31	100.32	99.85	100.21

*All analyses from Macdonald and Katsura (1964). Original sample numbers given below.

1. Honolua trachytic benmoreite, McGregor Point (C-92); field trip local. 3.

2. Wailuku tholeiitic olivine basalt below ash bed, field trip local. 4 (C-119)

3. Wailuku tholeiitic hypersthene-bearing olivine basalt; field trip local. 5 (C-120).

4. Wailuku olivine basalt transitional to ankaramite; field trip local. 6 (C-118).

5. Wailuku tholeiitic olivine basalt. Roadcut between field trip stops 5 and 6 (C-117).

6. Honolua trachyte, near base of dome, west wall of Ukumehame Canyon (C-116).

7. Lahaina basanite, Puu Kilea; field trip local. 8 (C-115).

Excellent views of Haleakala, Molokini Islet, the isthmus and the island of Lanai are available from McGregor Point. The prominant cone on the south flank of Haleakala is Puu Olai, a Hana Series cinder cone.

Mile 20.8 - Stop 4

An ash bed up to 1 meter thick separates tholeiitic plagioclase-phyric basalt below from alkalic olivine basalt above. This outcrop was originally mapped as interbedded Wailuku Series flows (Stearns and Macdonald, 1942), but Macdonald (Macdonald and Katsura, 1964) later suggested that the ash bed marks the boundary between the Wailuku and Honolua Series. The lower flow (Anal. 2, Table 1) is tholeiitic in terms of alkali versus silica variation. Petrographically, it consists of 1 mm phenocrysts of labradorite and microphenocrysts of olivine. Olivine is also present in the groundmass along with plagioclase, augite and opaques. The upper alkali olivine basalt locally contains 1 cm gabbroic clots or glomerocrysts.

Mile 21.6 - Stop 5

At least two flows of Wailuku Series tholeiitic hypersthene-bearing olivine basalt (Anal. 3, Table 1) here also contain scattered inclusions of dunite and rare olivine megacrysts. The rock is olivine-phyric with microphenocryst and groundmass grains of hypersthene. The dunite inclusions have cumulate texture. Inclusion-bearing lavas are exposed on both sides of the road. Along the road to the west is a 2-meter-thick ash bed, unconformably overlain by tholeiitic plagioclase-phyric basalt. The dunite-bearing flows in turn overlie this plagioclase basalt.

Mile 23.0 - Stop 6

A massive Wailuku Series olivine basalt at this locality contains abundant large phenocrysts of olivine with less abundant clinopyroxene; hence it is transitional to ankaramite. The whole-rock composition (Anal. 4, Table 1) and mineral compositions (Fodor and Keil, Chapt. 2, this section) indicate, however, that this sample has tholeiitic chemical affinity.

Mile 24.6 - Stop 7 (optional)

Ukumehame Valley is a large river-cut valley. The head of this valley is cut into the West Maui Caldera complex in which a spectacular dike complex is exposed. Stearns (1942a) rates this complex as the best exposed dike complex in the Hawaiian Islands.

A large vent-filling trachyte dome (Anal. 6, Table 1) and feeder dike are clearly visible in the west wall of Ukumehame Valley. An inclined Maui-type well near the mouth of this valley yields water with a temperature of 33°C. In conjunction with 25.5°C water from Olowalu Valley, these data indicate that this area is one with geothermal potential.

Mile 27.6 - Olowalu

Turn northeast (inland) onto the access road behind the store at Olowalu.

Mile 28.3 - Stop 8 - Puu Kilea

Kilea cone is a Lahaina Series cinder cone that produced a short massive flow of basanite (Anal. 7, Table 1). The rock contains abundant large olivine and smaller Ti-augite phenocrysts in a very fine-grained matrix that includes nepheline. The massive character of the flow provided an excellent surface for the production of pre-historic Hawaiian petroglyphs and of historic grafitti. Examples of both are preserved at this locality.

Mile 29.0

Return to Route 30. Proceed northwest.

Mile 29.9

View of Launiupoko soda trachyte dome and flow (see Stop 10).

Mile 34.7 - Lahaina

The old whaling port and modern center of Lahaina, established in 1825, lies to the west. Missionaries established the Lahainaluna School, the first such school in the islands, in the hills to the east in 1831. A well near Lahaina yields 28°C water, indicating geothermal potential in this area.

North of Lahaina the road passes west of Puu Laina, a Lahaina Series basanite cone. A flow issuing from this cone crossed under the present road but is poorly exposed.

Mile 37.6

Take the first Kaanapali turnoff and proceed north.

Mile 39.2 - Stop 9 - Kekaa Point

Kekaa Point is the site of Lahaina Series cinder cone, as well as of a modern tourist hotel. A cross section through the cone is well-exposed along the walkway near the beach. Cinder, bombs, spatter and flow fragments are exposed along the path.

Return south along Route 30.

Mile 49.2

Turn inland along the access road.

Mile 49.7 - Stop 10 (optional)

A Honolua basaltic cinder cone has been partly quarried away at this site. To the north is Puu Mahanalua Nui, site of the Honolua Series Launiupoko trachyte dome and flow (see Fig. 2, Chapt. 1). McDougall (1964) dated a sample from this flow at 1.17 m.y.

Haleakala Crater

Haleakala Crater is about 7 miles long by 2 miles wide and about half a mile deep. It has been called the largest extinct volcanic crater in the world. However, this statement is incorrect on many accounts. As pointed out by Macdonald and Abbott (1970), "Haleakala is far smaller than many volcanic craters (calderas); there is an excellent chance that it is not extinct, but only dormant; and strictly speaking it is not of volcanic origin, beyond the fact that it exists in a volcanic mountain." Stearns (1942b) established the erosional origin of Haleakala Crater, formed mainly during the period of quiesence between Kula and Hana eruptions. Post-erosional Hana eruptions produced some of the spectacular volcanic land forms present in the crater.

Haleakala Crater is one of the few localities in Hawaii that has been mapped in detail. Field trip participants are strongly encouraged to obtain a copy of the map by Macdonald (1978) before entering the crater. The trip outlined below covers 11.3 miles, and takes 7-10 hours depending on individual hiking speeds. Weather conditions in Haleakala Crater are typical of high altitudes where one is subject to exposure to sun and wind. Adequate protection from sun, wind, rain and cold are necessary at all times of the year. Haleakala Crater comprises part of Haleakala National Park; collecting permits for geological and botanical specimens must be obtained from The Director, Haleakala National Park, P. O. Box 537, Makawao, Maui, Hawaii 96768, U.S.A.

The road leading to Haleakala Crater passes through Kula Series flows and cones. Rare, crudely columnar jointed flows are exposed about 3 miles before the entrance to the park. The road passes through Puu Nianiau, a Kula cinder cone at the park entrace. From the park entrance to Haleakala summit, the road again mainly traverses Kula Series flows. All mileages given below are approximate.

Mile 0 - Haleakala Observatory

The trail head is at the west end of the parking lot for the Pakaoao (White Hill) Observatory. Sliding Sands Trail commences in a blanket of cinders shed from Red Hill, a Kula cinder cone. The trail then leads through crater talus on the descent into the crater.

Mile 1.35

Indurated talus breccias are exposed just to the north of the trail as it switches back from north to southeast. Spectacular overlooks of Haleakala Crater are realized all along the trail.

Mile 2.0

Intersection of Sliding Sands Trail with a subsidiary trail leading to Kaluu O Ka Oo, a Hana Series cinder cone. This very young cone produced a nearly aphyric basanitoid flow.

Mile 2.1

The trail crosses a Hana Series lava flow. This lava is olivine-phyric basalt or basanitoid.

Mile 3.8

Intersection of Sliding Sands Trail with trail leading to Pele's Pig Pen and Holua Cabin. Take trail leading north toward Holua Cabin.

This trail traverses Hana Series flows including nearly aphyric olivine basalt or basanitoid, issuing from Puu Kamaolii.

Mile 4.4

The trail ascends the western shoulder of Ka Moa o Pele, a Hana Series cinder cone. Views to the west of the cones, Puu o Pele, Puu o Maui and Kamaolii are realized along this trail.

Mile 4.7

As the trail reaches the saddle between Ka Moa o Pele and the cinder blanket to the north, Pele's Pig Pen can be seen to the east.

Mile 5.0 - Pele's Pig Pen

This locality marks the site of a small spatter cone and flow issuing to the northwest. Natural levees along this flow produced the "pig run."

Follow Halemauu Trail towards Holua Cabin. Optional side trips to Bottomless Pit, a very dip fissure adds about 0.75 miles.

Mile 5.1

Semi-consolidated ash sheets are exposed along the trail on the slopes of Halalii. These ash beds contain delicate accretionary lapilli. Several varieties of bombs are also present along the trail.

Mile 5.3

The trail traverses the plain leading to Holua Cabin. At this locality the trail crosses an olivine and augite-phyric flow erupted from the base of Halalii.

Mile 6.3 - Silversword Loop

The Silversword Loop side trail leaves Halemauu Trail in Hana Series porphyritic olivine basanitoid from Puu O Maui (Anal. 1, Table 2).

Mile 7.1

The trail here crosses the nearly aphyric basanitoid flow (Anal. 2, Table 2) from Kaluu O Ka Oo.

Mile 7.3

Good Pahoehoe flow features are exposed along the trail in older Hana basalts. A small pit crater is also exposed alongside of the trail.

Mile 7.4 - Holua Cabin

Fresh water is available from the tank behind Holua Cabin. Kula Series flows and dikes make up the crater walls to the west. From Holua Cabin, Halemauu Trail crosses older Hana basalts and alluvium.

Mile 8.4

Kula Series alkalic olivine basalt (Anal. 3, Table 2) is exposed at the gate at the bottom of the switchbacks of Halemauu Trail. This rock has phenocrysts of plagioclase and olivine with 1.42% normative nepheline.

From here Halemauu Trail climbs up through Kula Series basalts, hawaiites (Anal. 4, Table 2) and mugearites (Anal. 5, Table 2). Several dikes are also exposed along this trail section. Eastern convex switchbacks provide excellent views (weather permitting) out Koolau Gap along the Kaenae watershed to the sea.

Mile 10.3

The trail leaves the steep section in undifferentiated Kula Series flows and passes into Kula hawaiites.

Mile 10.8

Take the left trail leading to the summit road. The right-hand trail leads down to Hosmer Grove.

Mile 11.7

Trail end, intersection with summit road.

ACKNOWLEDGMENTS

Much of the information contained in this section is from the work of Stearns (1942a), Stearns and Macdonald (1942), Macdonald and Powers (1968) and Macdonald (1978), although my personal observations have been added where appropriate. The assistance of M. Smith and J. Oka in preparing the field trip guide is greatly appreciated. JoAnn Oka drafted Figure 1, for which I am grateful.

Table 2. Lavas of Haleakala Crater*

	1	2	3	4	5
SiO_2	42.46	41.55	44.72	46.31	51.90
TiO_2	3.08	4.10	3.96	3.67	2.11
Al_2O_3	12.57	14.13	13.86	15.29	17.10
Fe_2O_3	4.90	3.99	5.69	4.02	3.38
FeO	9.98	11.36	9.82	8.84	6.64
MnO	0.17	0.19	0.23	0.19	0.17
MgO	9.37	6.04	5.07	4.86	2.26
CaO	11.77	11.79	10.89	9.76	5.70
Na_2O	2.96	3.84	3.07	3.72	6.65
K_2O	1.27	1.67	1.09	1.47	2.72
P_2O_5	0.45	0.63	0.61	0.74	0.84
H_2O^+	0.36	0.05	0.40	0.38	0.34
H_2O^-	0.08	0.23	0.33	0.39	0.29
Total	99.42	99.57	99.74	99.64	100.00

*All analyses from Macdonald and Powers (1968).

1. Hana basanitoid flow from Puu o Maui, on trail 0.65 mile from Holua Cabin, Haleakala Crater.

2. Hana basanitoid flow from Kaluu o Ka Oo, on trail 0.3 mile from Holua Cabin, Haleakala Crater.

3. Kula alkalic olivine basalt, gate at foot of switchbacks on Halemauu Trail, west edge of Haleakala Crater.

4. Kula hawaiite, aa lava flow, 6940 ft altitude on Halemauu Trail, Haleakala Crater.

5. Kula mugearite, ca. 7300 ft altitude, Halemauu Trail, Haleakala Crater.

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