MAUNA KEA: FORMS & PROCESSES (ENDOGENIC & EXOGENIC)

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FIG. I: Mauna Kea Volcano and the cinder cones around its summit

INTRODUCTION

Mauna Kea is a post-shield volcano located on the island of Hawaii. (Fig. I) It is the tallest volcano on the island as well as claimed to be the tallest mountain in the world if measured in terms of its absolute height (dry prominenc-e). It is about 1 million years old (formed during the early Quaternary Era) and has past its active stage thousand-s of years ago. Currently, it is dormant with the last know n eruption subsiding 4 to 6 thousand years ago. Its sum-mit is extensively used as an astronomical observation si te due to its high elevation, stable air flow regime and a dry environment. Due to its large size, several kinds of la ndforms have evolved over time through endogenic and exogenic processes.

ENDOGENIC: MAGMATIC, SEISMIC & TECTONIC FEATURES

Mauna Kea is a member of a series of hotspot volcanos that were formed by the Hawaiian hotspot which actively penetrates the pacific plate since atleast 18 mya. The archipelago formed by the hotspot volcanos are together known as the 'Hawaiian Emperor Seamount Chain' (Fig.II). These also aid in studies related to paleotectonic movement-s of the Pacific Plate.

The volcano developed over preexisting lava flows from early Kohala rift valley system. This resulted in the newe -r lava flows from the Mauna Kea bedding over the older Kohala rift zones. Hilo Ridge is a part of the same rift zone that was left unburied and can be seen to the east of the volcano (Fig. III).

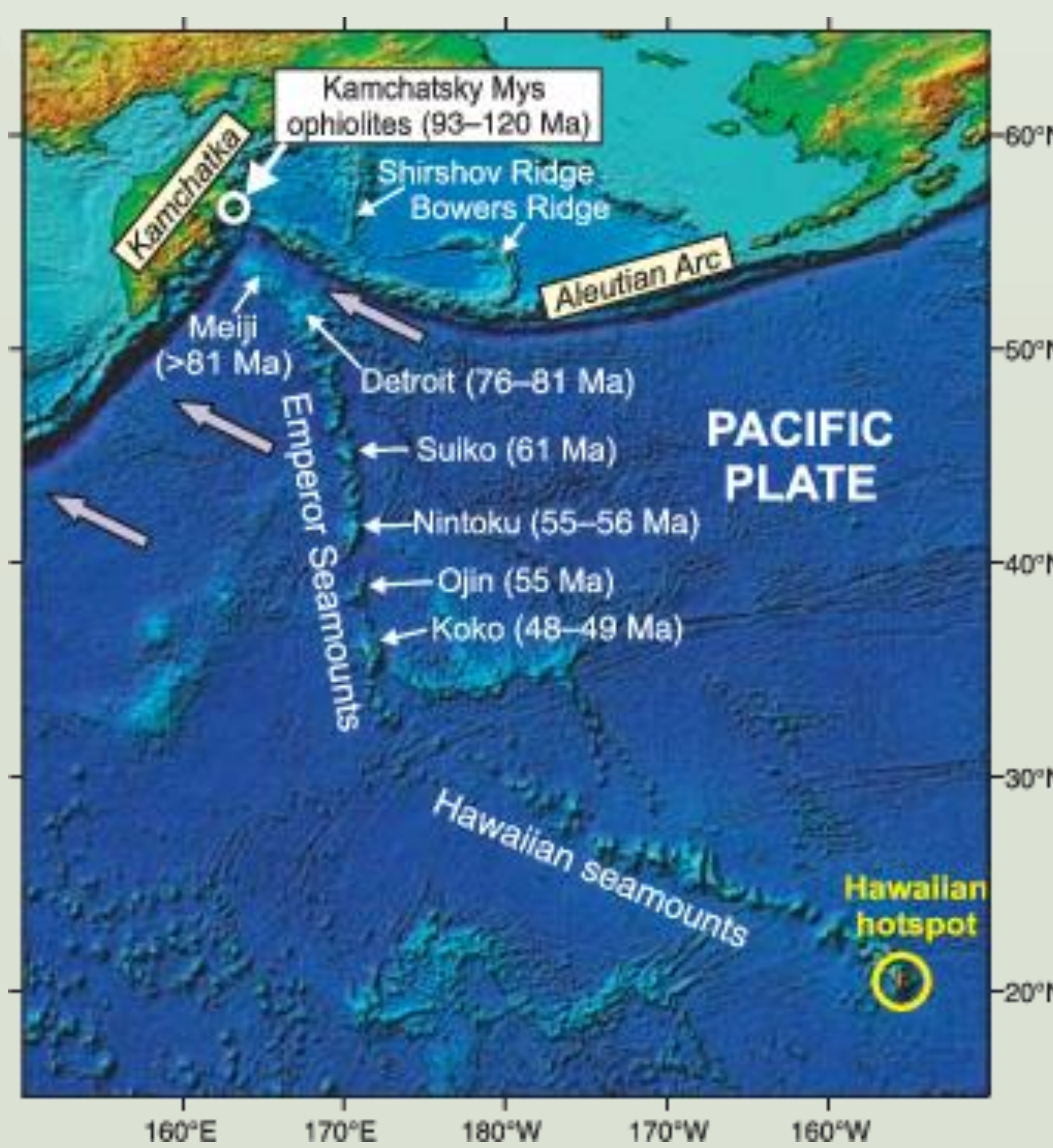

FIG. II: Hawaiian Emperor Seamount Chain

The volcano is primarily built by cooling of Tholeiitic Bas-altic lava flows. These rocks are layered over by Alkali B-asalts which formed during the mid Pleistocene epoch post-shield volcanism of Mauna Kea. The youngest rock bed is formed by the late Pleistocene post shield volcani-sm that expelled more viscous flows consisting of Hawaii tes and Mugearites. The dense flow can also be attribute d to the steep flanks of the volcano. The last of the erupti -ons being more viscous, generated pyroclastic flows and thereby formed the cinder cones visible at the summit.

Presently, a prominent summit caldehra is absent for the volcano. However, smaller cinder cones are visible at the summit, indicating that the calehra was completely burie-d post collapse of the eruption deposits (Fig. I). The volc-ano is also constantly observed to flatten under its own weight at a rate of 0.2 mm per year. The structural stabilt y of the volcano is east heavy and locally depresses the pacific plate underneath it by a maximum of about 6 kms

While the Kohala rift valley has 4 major associated fault systems, none of them are visible at the surface due to being blanketed by the younger volcano. The volcano itself does not have major faulting or folding features, even though the region frequently (periodicity 7 to 12 mi-ns) undergoes mild deep-earth seismic activities.This is due to cooling of the magma in the deep earth and is a unique feature of the Mauna Kea.

EXOGENIC: GLACIAL, FLUVIAL, TERRESTRIAL, COASTAL, PNEUMATIC & BIOLOGICAL FEATURES

The lower eastern flank of the volcano stands adjacent to 2 prehistoric, submarine landslides / slumps; namely the Laupahoehoe slump and the Palulu Slump, both of which are resultants from the erosion of the Kohala lava flows (Fig. III).

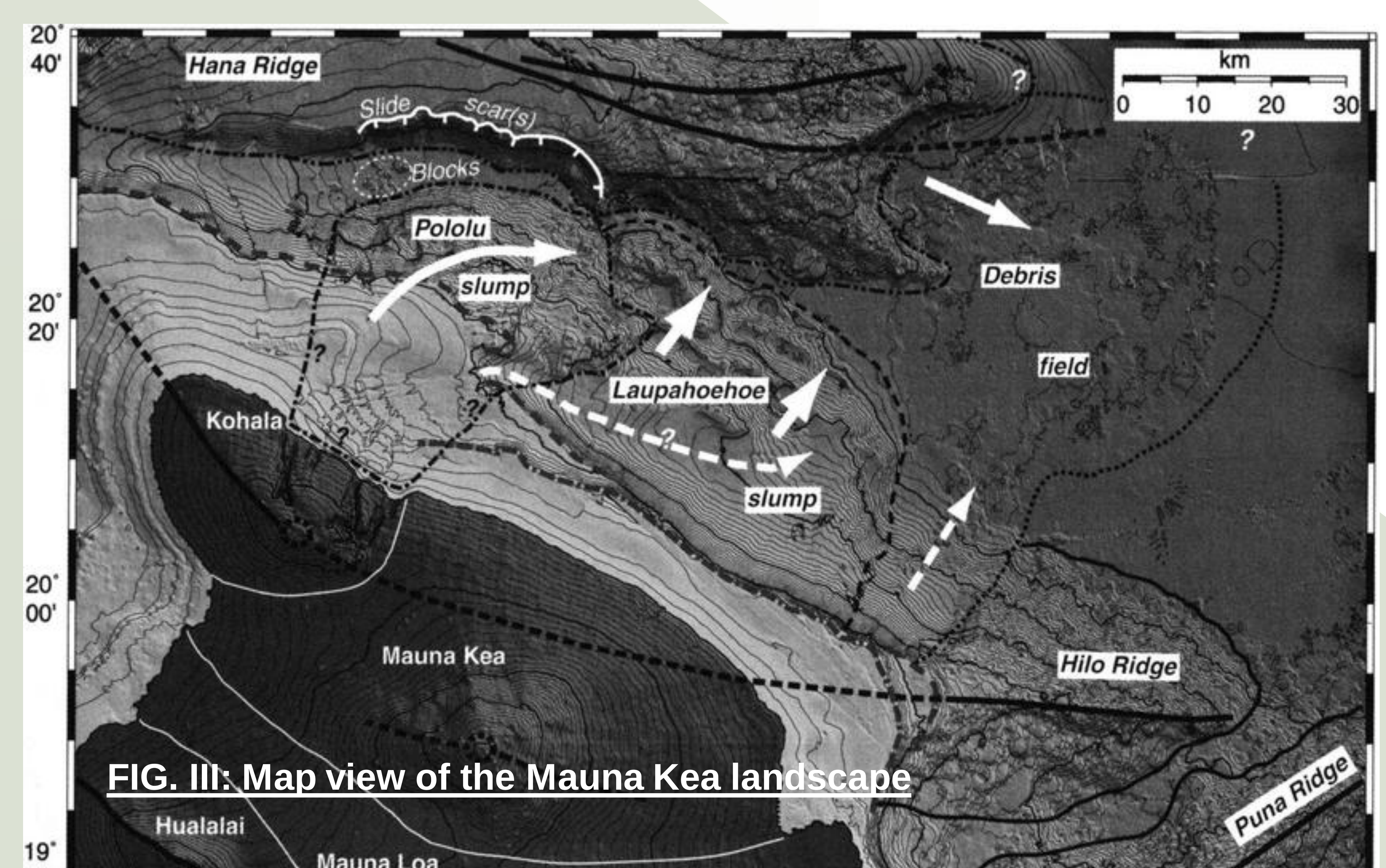

FIG. III: Map view of the Mauna Kea landscape

The soil around the volcano majorly consists of volcanic ash deposits composed mainly of Fe and Al oxides from the rocks types discussed earlier. These are weathered over time by trade-winds induced precipitation to give the characteristic Hilo Soil.

Throughout Mauna Kea's history, there have been 3 glac -iation events at its summit as evidenced by the remnent glaciation tills. A small body of permafrost formed during the last glaciation was found in the last century and may still be present at the summit today. Glacial and ephemer -al fluvial gullies formed during the wet seasons facilitate weathering of the substrate which is further accelerated by the action of trade winds.

Despite high infiltration rates of the Hawaiian lava rock type, some sulfur based steam action has rendered the surface of the Puhu Waiau cinder cone to house a glacia l fed mature basin. It is the only alpine basin in the Hawa -iian state.

There are also several artesian aquifers across the volca -nic landscape which are refilled by the precipitational and glacial runoffs.

Mauna Kea houses several vegetational profiles and habitats such as stone deserts, shrublands, alpine woodlands and tropical forests.

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