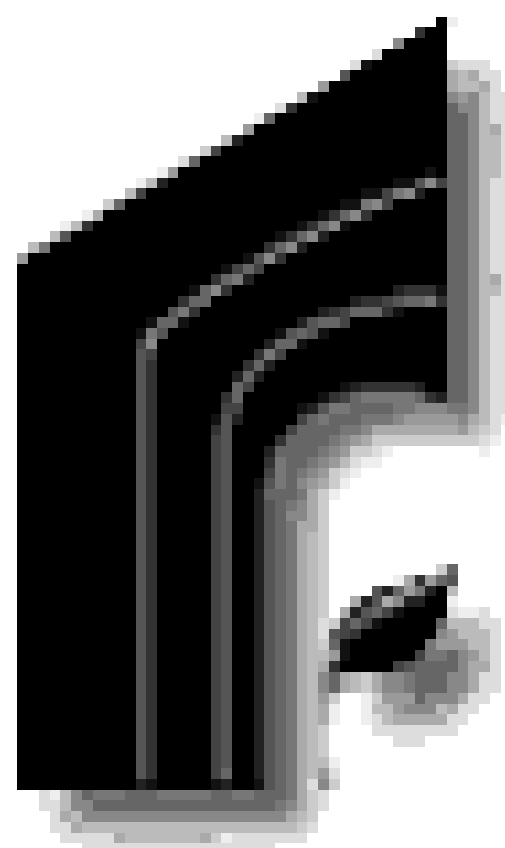


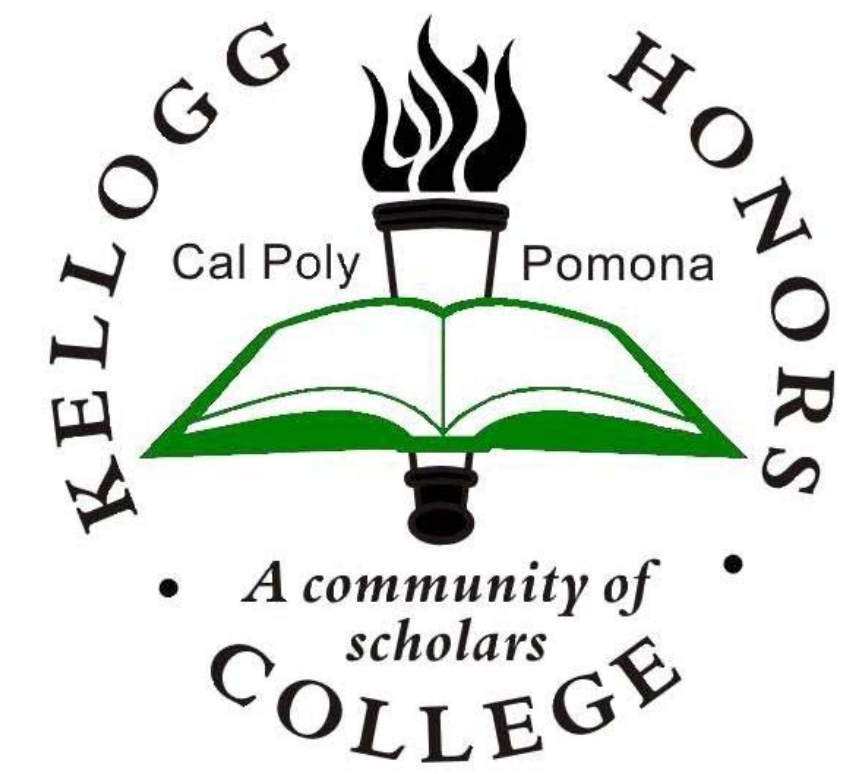
# Tectonic Analysis of Faulting on the South Flank of Kilauea, Hawaii



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## Abstract:

The goal of this research project was to examine the fault systems on the south flank of Hawaii. The Kilauea volcano is responsible for much of the seismic activity in the area. Using the Generic Mapping Tools (GMT) software package, earthquake catalog data was plotted on a map of Hawaii, and in cross section. One earthquake catalog contains highly accurate data on the location and depth of the seismicity (recently generated by Robin Matoza at UCSD), as well as the magnitude of the events. The second catalog includes focal mechanisms for the larger earthquakes, which indicate the geometry and style of faulting of the events. By plotting earthquakes in cross sections and map-view, they can be associated with known fault systems. Using literature data about fault geometry, cross sections were plotted perpendicular to the fault systems to create two dimensional fault maps. The required input parameters to generate these cross-sections of seismicity are the start and end points, depth, width, and minimum magnitude readings. Two of the important fault systems that have been mapped in this way are the Koa'e Fault System, and the Hilina Fault system. The Koa'e Fault system is poorly understood in terms of geometry. Due to this fact, seismic hazard is not fully evaluated. Interpreting data from this fault can aid in understanding this fault system.

By creating these cross sections at regular intervals, different types of alignment of seismicity may be observed. The alignment of seismic data may be due to faults, lithosphere boundaries and volcanic structures. By investigating these structures an enhanced knowledge of fault geometries can be used to improve hazard analysis. Additionally, by mapping on each separate fault, each structure may be analyzed the structures and recording the number of events in an area, activity on each of the fault can be discovered.

## Background Information

The Hawaii Island Chain is the product of hotspot volcanism. In hotspot volcanism, mantle plumes from the lower mantle create volcanoes on the ocean floor. In the case of Hawaii, These volcanoes produce lava, which, through many eruptions form islands. As the earth's tectonic plates move, new volcanoes form due to the fact that the plates move over the hotspot. This plate movement causes island chains to be formed, like the Hawaii islands. The direction of plate movement determines how the islands are aligned. The current trend of the Hawaiian Islands is from northwest to southeast. On the Island of Hawaii, the currently most active volcano is that of Kilauea. Located on the Southeast flank of Mauna Loa, Kilauea is associated with an active volcano, faulting, and earthquakes. Due to active volcanism, the area is at risk for earthquakes, lava flows, and tsunamis. In the past these three natural hazards have caused a great amount of damage and loss of life.

The data presented is high quality seismic event locations from Robin Matoza of UCSD. The dots represent the location of seismic events in terms of three-dimensional location. The color represents depth, and the size of each dot represents the magnitude of each event relative to others. Using this data, subsurface features like faults can be shown in cross section.

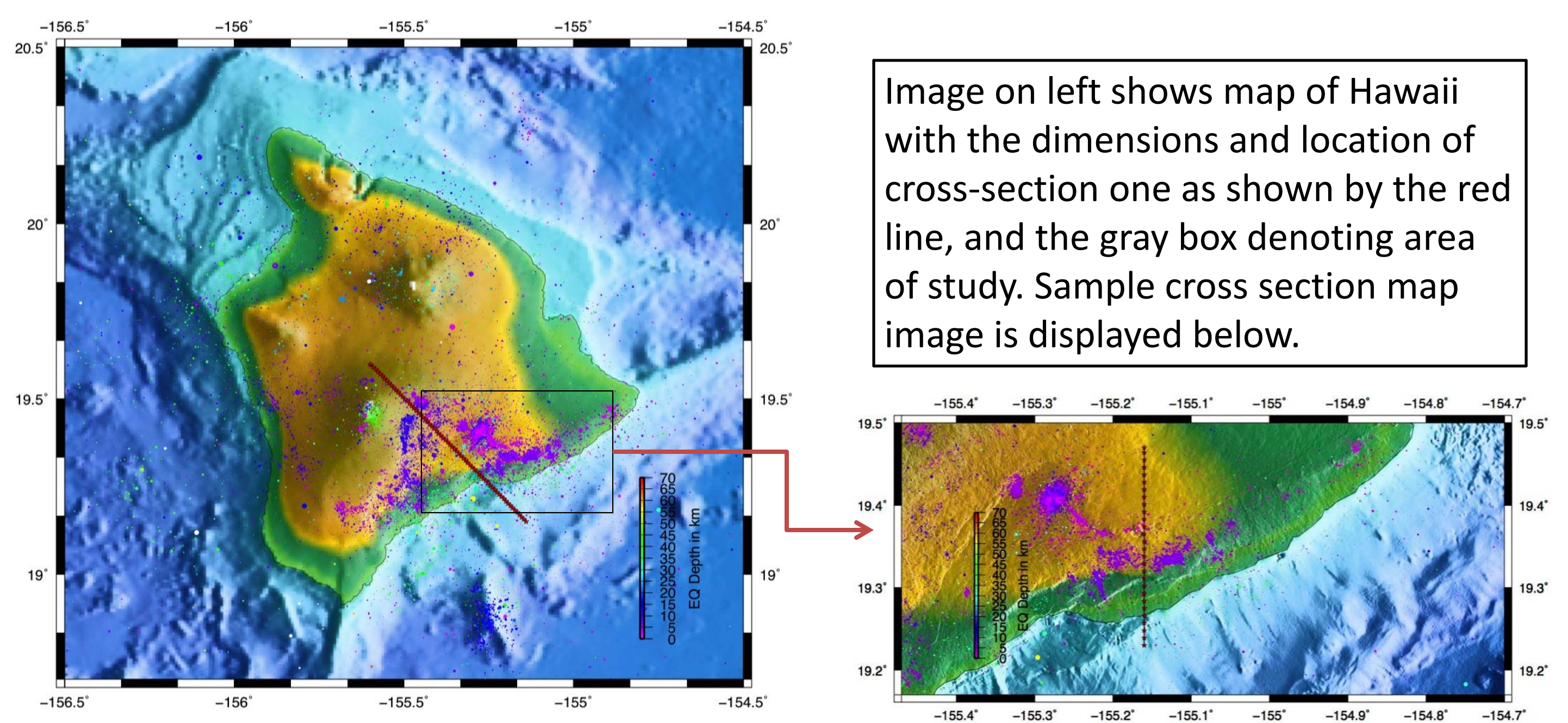
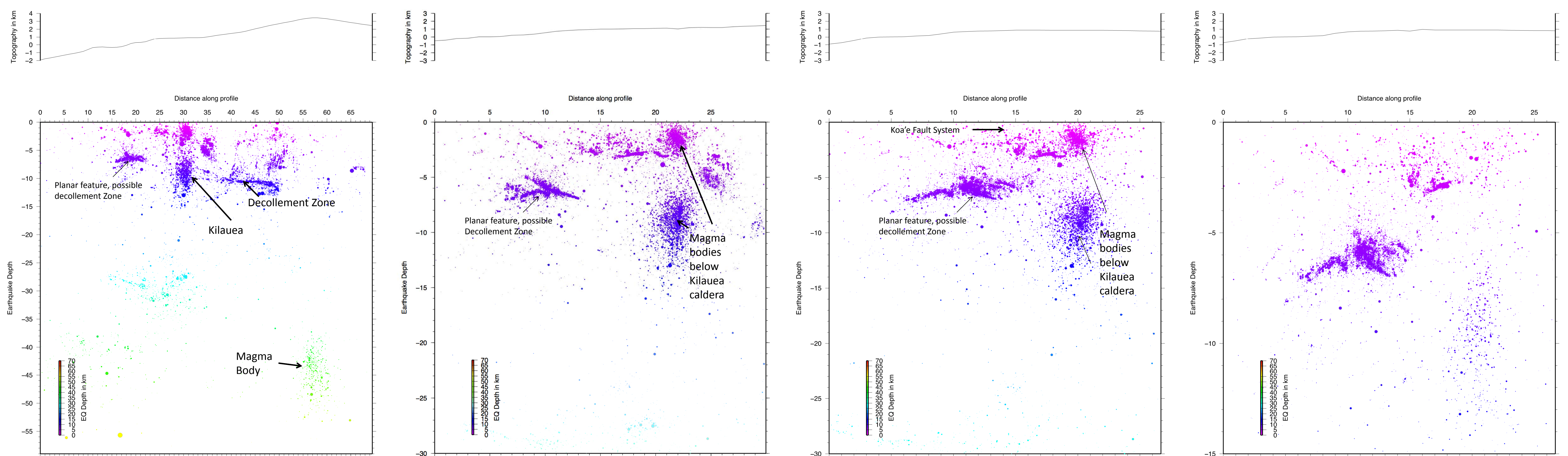


Image on left shows map of Hawaii with the dimensions and location of cross-section one as shown by the red line, and the gray box denoting area of study. Sample cross section map image is displayed below.



## Discussion of Cross Sections

Each of the cross sections show structures under the south flank of Hawaii. Cross section one is a large scale cross section which shows a wider range of data, at the expense of precision. In this cross section, a few features can be picked out. The blue planar feature is at the same depth as the contact zone between the volcano and oceanic crust known as the decollement zone. This decollement represents a sliding surface between the two types of crust. Also represented is seismicity due to the magma underneath the crater of Kilauea. The group of purple and blue-purple earthquake locations on the cross section below 30 km represents this magma structure. The other groups of earthquake locations represent other planar features where the locations align. Cross-section two shows a more detailed section that runs straight through the south flank of Kilauea. The vertical pattern of seismic events starting at 20 km and ending at 25 km along the cross section potentially represents the magma chamber and the feeder structure for Kilauea's caldera. Other planar features in the cross section are most likely faulting due to the stress of volcanism on the south flank. Cross section three is a north-south cross section. Magma structures are visible at around 20 km along the cross section. At 14 km is a small planar feature, which may be the Koa'e fault system. The location at the surface is within the area of the Koa'e fault system. The purple planar feature is still unclear, however it is near potential magma chambers. The fourth cross section is a shallower view of cross section three. In this cross section the Koa'e fault system appears to be present in the same area of the cross section as in cross section three.

## Future Research

The cross sections presented in this poster were made using high precision earthquake locations from Robin Matoza at UCSD. The next stage of this research will be the inclusion of focal mechanism data, which will provide further information on the geometry and style of faulting in this region.

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