Dave Clague discussion: 1 Feb 2007

Landslides on Ocean Island Volcanoes

UBC:
What are the advantages/disadvantages of the various geophysical techniques mentioned? What vertical/horizontal resolutions can be obtained with sonar vs GLORIA? What processing is typically done to these data? Are older events likely to have wavelengths that are too long to detect? (*Heather*)

MTU:
What methods exist for assigning ages to submarine landslides? (*Julie*)

UNAM:
What controls the length of the landslide and what is the seawater effect on avalanche flow and emplacement?

SFU:
On **slide 14** the diagram (volume vs runout) shows a lot of scatter but the peak, ie. distance travelled by the largest blocks appears to be further from the source that one would expect. Can you comment on this in terms of driving forces vs. resistance (e.g, water mass, inertia, etc.)? *(Chris)*

Buffalo:
Is there evidence the landslides continue to slide long after the initial event. And, if they do, does it seem to be simply the result of faulting or is it perhaps influenced by the mineralogy and hydrothermal fluids luberacating the continued slide? (*Leila*)

McGill:
What is the nature of fluid flow in the clastic apron surrounding ocean islands, and what are the implications for instability?

ASU:
How fluidized (dilute vs. concentrated) are the flows resulting from large landslides at oceanic volcanoes as they travel under water?

UNAM:
What is the most important characteristic about behaviour of debris avalanches in deltas in shallow water and avalanches in deep water?

COLIMA:
Hydrology:
1. (Slide 44) To what extent does excessive rainfall (Particuarly concentrated on tropical regions such as Hawaii) induce or exacerbate sub-ariel slumping? Are there there further hydrological processes to concider such as instability caused by phreatic volcanism? (*A. Browning*)

UBC:
From the Moore et al Paper- p.17,480
'*Major landsliding occurs through the growth of hawaiian volcanoes- and continues at a reduced rate long after dormancy*'
If this is the case- Can we imply from this that major landslides are more dependent on faulting (near-by seismic activity) vs. magma injection or chamber activity? How do modellers approach this issue? (*Rebecca-Ellen*)

MTU:
I've been told that radial vents do not exist along Mauna Loa's southern flank as a result of Kilauea's pressure as it deforms and inflates over time. The two volcanoes share the pressure of inflation (both are constantly deforming as a result of magmatic processes) and this prompts me to ask how much does Mauna Loa contribute to slope failures on Kilauea and vice versa? (*Julie*)

SFU:
Mention of these continued mass wasting during the growth/islands of the volcanic islands is made for Hawaii, Canaries, Caribbean, Reunion, etc. but has there been any work on the Galapagos or Iceland which are also extremely large and active volcanic islands?

Buffalo:
On the paper by Moore et al.:
What are the transport mechanisms for the large hummocky blocks found 50 km from Oahu (i.e. Nuuanu debris avalanche) ? Are they moved farther from the island via post-depositional fault-block sliding, rolling from the canyons, or are they a product of some enormous eruption force? (*Erik*)

McGill:
Is there a correlation between gaps in volcanic activity and intensity of faulting? For instance at the Canary Islands where activity often stops and restarts, would we expect the sudden burst in activity after there has been a gap to result in a greater degree of faulting compared to Hawaii where activity is constant? (Could irregularities in volcanic activity decrease the stability of a volcano and make it more susceptible to landslides?

ASU:
One article states that ocean island collapse deposits transition into turbidites distal from source. Is this transition gradual or abrupt? Is this observed at all oceanic collapses or is it a rare occurrence? Does the presence of distal turbidites provide unique information on the mechanics of the flow?

UNAM:
Could you explain about instability due to low resistance layers?

COLIMA:
Petrology:
1. (Slide 59) The involvement of dunite in volcano destabilization suggests that this process occurs far beneath the surface, and thus would destabilize even those volcanoes no longer erupting large volumes of tholeiitic lavas. Does the flow of dunite promote the spreading and

destabilization of the entire volcanic edifice, or is its influence more localized to the active flanks? (*L. Nielsen*)

UBC:
Submarine vs aerial canyons – is the presence of these submarine canyons related to paleobathymetry and why is a tendendancy to go through repeated incision of pre-existant canyones? (*Rebecca-Ellen*)

MTU:
How much of a geologic record exists for tsunamigenic landslides occurring in Hawai`i? The catastrophic failures around the islands have left an impressive mark on the ocean floor, but have the islands (or any distant shores) been greatly affected by tsunamis resulting from these events? (*Julie*)

Buffalo:
Could you speak more about the role of landlsides in shaping the Hawaiian Deep? (*Sarah*)

SFU:
Are all or most of the debris avalanches able to flow over significant topography? For example, mention was made of debris avalanches climbing 100s m high topography. (*Guillaume*).

McGill:
Unlike Hawaii, slow slumping seems to play no significant role on the Canaries and on Reunion, why?

ASU:
The mention of turbidite deposits suggests sedimentary structures within these distal avalanche margins (i.e. graded bedding, cross-bedding). Have cores been obtained from these distal margins, and if so, do they reveal sedimentary structures?

More Questions

SFU:

1. While these studies seem to concentrate on ocean island volcanoes, has there been any evidence of similar mass wasting on inland island volcanoes (e.g., Concepcion volcano in Lake Nicaragua) (*Guillaume*)?
2. With these very large events, is there any evidence of uplift of the edifice following the failures? (*Terry*)
3. What studies have been done comparing failures on Olympus Mons (Mars) vs the Hawaiian or Canaries landslides? (*Chris*)

McGill:

1. How does the process of slumping compare in oceanic and non-oceanic volcanoes?" It is mentioned to be an important process for mass wasting at Hawaii in the Moore paper, but not discussed in the previous discussions about terrestrial debris avalanches.
2. Why are landslide volumes originating from oceanic volcanoes larger than landslide volumes from non-oceanic volcanoes? (see Holcomb, 1991; Fig. 6)
3. Following Q4, which factors determine whether slow slumping or rapid debri avalanches take place?

Buffalo:

On Juan Carlos Carracedo's Paper:

1. Why does Hawaii have such a high subsidance rate compared to the Canary Islands? (this may not be a relevant question: I'm just curious). (*Erik*)

2. Slumps tend to happen while the volcanic rifts are still active. Is it fair to say that debris avalanches are more likely to occur during the post-volcanic erosional phase? (*Marc*)

3. In the last 10,000 years has global sea-level rise or subsidence of the Hawaiian chain been the more important contributor to relative sea-level changes in Hawaii? How has this impacted the likelihood of slides? (*Marc*)

3b. Will global warming result in increased rainfall in Hawaii? In the Canaries? Will this increase the likelihood of sliding? (*Marc*)

4. Elaborate on clay mineralogy in slide 35 (*Marc*)

5. Elaborate on Mauna Loa cross-section in slide 36 - ? subaerial pillow basalts (*Marc*)

6. Slide 44 Is seismic activity required to trigger a slump? (*Marc*)

7. Slide 50 describe sequence (*Marc*)

From the Carracedo paper:

8. Why is there no subsidence in the Canary Islands and so much in the Hawaiian Islands? (*Sarah*)
9. Why is it impossible to evaluate the volume removed by lateral collapses? (*Sarah*)

MTU:
1. We've seen that Kilauea's Hilina Slump has responded to earthquakes and magmatic intrusion but is there constant creep? (*Julie*)

2. Is there any correlation between radial vents and slope failure? I'm interested in the flat-topped submarine volcanoes you have studied; do they occur in areas affected by landslides or slumping? (*Julie*)

3. We saw last week that large scale volcanic landslides could happen at very low angles, but this week's presentation seems to state that at least in Hawaii the movements are require "steep unbuttressed slopes." Is this a function of the chemical make up of the volcano or more a result of the relatively calm geologic settings of these volcanoes and the fact that they are completely dormant? (*Kyle*)

ASU:
1. At the time of collapse, are the source regions for the landslides solely above sea level?

2. How much overpressure is generated during dyke emplacement at oceanic volcanoes?

3. Are toreva blocks more likely to be found in subaqueous avalanche deposits than subaerial deposits?

UNAM:
1. What is the most important triggering agent in the cases of submarine volcanic landslides?