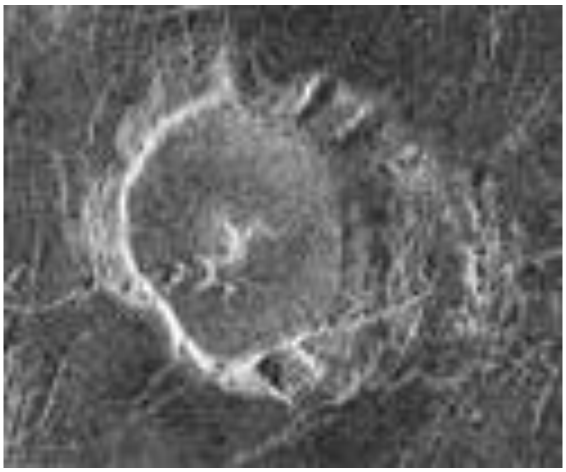
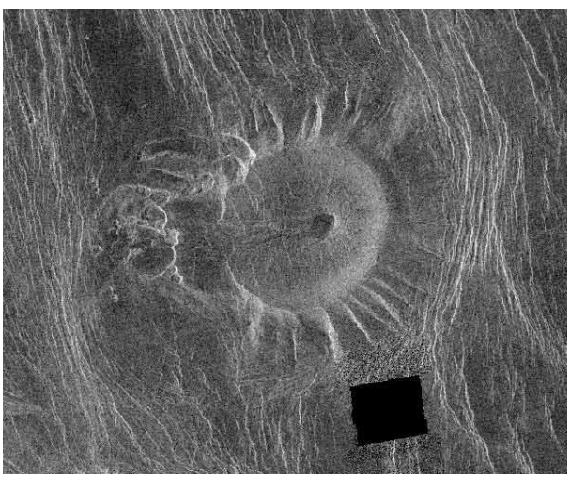
THE FLAT TOPPED VOLCANOES OF VENUS: PROCESSES AND POSSIBLE ANALOGUES. J.H.J. Leach, Department of Geomatics, University of Melbourne, Parkville, Victoria, Australia.

The similarity between many of the small to medium volcanoes on Venus and rhyolite domes on Earth was noted early in the investigation of the Magellan data[1]. These domes have a distinctive form because of the high viscosity of their lava. There was, however, one class of the volcanoes recorded by Pavi et al. [2] which is not easy to explain in this way [3], These are the flat topped, mesa-like domes. It also seems likely that the so called "tick" volcanoes ot scalloped edges domes are related to this class[4].



Venusian flat topped vocanic dome.



Venusian "tick" or scalloped margin dome.

The form that an eruptive landform takes depends on the relationship between the rate of eruption and the rate of flow of the erupted lava away from the eruption point. This depends critically on the viscosity of the lava. The volcanic province of Victoria, in southern Australia, has a range of eruption types from basaltic fissure eruptions, with no discernable eruption point topography, through basaltic shields and rhyolite domes, to the mammilon like extrusions of the soda trachites [5], No where in this sequence, however, do we see the mesa-like features of the flat topped domes – suggesting that viscosity alone was not responsible for their formation. To achieve such a form, something must restrict the lava flow to a specific radius from the eruption point.

Some possible terrestrial analogues have been identified, The flat topped sea mounts seen in GLORIA imagery have been suggested [6]. Here the formation of pillow basalts seems to have limited the lateral flow of the lava. A similar situation occurs of the southern Australian coast where Lady Julia Percy Island, a primary eruption construct, forms a flat topped volcano bounded by cliffs of pillow basalt which were formed at a previous higher sea level. It is, however, hard to see how this process could function on Venus, The tuyas of Iceland offer yet another example of flat topped volcanic forms, In these cases it is glacial ice which has restricted the lateral flow. Again, it is hard to see how this process could occur on Venus.

Lady Julia Percy Island

There is another class of flat topped volcanic features which occur in the South east Australian volcanic province but they are not primary forms. They occur where late stage lava has erupted into the crater of a pre-existing scoria cone. Here the scoria acts to restrict the lateral flow, resulting in a basalt plug. Once the scoria is eroded, this plug is left as a flat topped hill. Examples of this type of formation include Mt. Aitken and Warrion Hill [6]. The key point here is that the eruption occurred into a material which was friable enough that the lava was erupted *into* rather than *through* it and yet strong enough to restrict its lateral flow. Scoria is unlikely to be the restricting material on Venus since scoria eruption, which involve water, are unlikely to occur. However, another material, eg. surficial sand deposits, could be a substitute allowing this process to occur.

Mt Aitken, view from the east.

Mt Aitken, from above.

An intriguing possibility is that this material is still there but invisible to the Magellan RADAR. Similar systems on Earth have been shown to penetrate many meters of dry sand [7]. Indeed, the scalloped edged domes may be formed when this material is removed by erosion and the slopes of the flat topped dome, previously buttressed by the surrounding material, become unstable and collapse.

The flat topped, mesa-like volcanoes of Venus are something of a puzzle. This paper has tried to use some possible terrestrial analogues to look at the fundamental processes that are responsible for their formation.

References: [1] Head et al. 1992 JGR 97, 13, 153, [2] Pavi et al.1992 JGR 97, 13, 445, [3] Aubele 1992 LPSC xxiv, 47 [4] Guest et al. 1992 JGR 97, 13, 949, [5] Singelton et al. 1973 in *Regional Guide to Victorian Geology*, School of Geology, University of Melbourne, Australia. [6] USGS Misc. Inves. Series I-1792, 1986, [7] Elachi etal. 1984, IEEE Trans. Geosci. Rem. Sens., V., GE-22, p.383-388.