



Volcanic morphology, volcano alignment and basement structure in the Limagne Fault and Chaîne des Puys: perspectives for remote sensing in the solar system

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The Limagne Fault, is an Eocene half graben, that has undergone about 1 km of uplift in the Quaternary and Holocene. The Chaîne de Puys is a classic volcanic alignment located on the uplifted footwall block of the Limagne fault. This study describes the morphometry of the volcanoes, analyses the alignment of the cones, and the structure of the basement and fault, to investigate the relationships. This work has been inspired by a UNESCO world heritage proposal, and the wish to understand the link between the faulting, the tectonics and the volcanism, to provide a well studied terrestrial analogue for remote sensing studies on other planets. The volcanoes show distinct NE-SW elongations, and local NNE-SSW alignments and an overall NS trend. Interestingly the scoria cones and domes show strong similarity in their morphometric signature, suggesting that morphometry may not alone be able to distinguish different volcanic types from topographic data, unless subtle differences are taken into account. The similarity originates in the similarity of construction – domes and cones are principally scree piles. Basement fractures are predominantly NE and NNE-SSW orientated with minor EW and NS components. The basement lithology is strongly isotropic with major NE-SW and NNE-SSW dykes shear zones and alteration zones as well as NNE-SSW changes between granite, gneiss and schist. Exploration in the Limagne Graben shows a major NE-SW trend of faults entering the North of the Chaîne des Puys area, and this faulting was accommodated by the Limagne fault possible as a fault splay system. No Quaternary or Holocene fault movement has been identified, though seismic activity does occur and there have been historical accounts of earthquakes. However, there is plenty of clear evidence of intrusion-related deformation within the volcanic chain. In all, there is a clear link between inherited Hercynian basement lithology and structure and the volcanic forms and alignments, but little evidence of active tectonic control on the volcanism. This study raise an important cautionary note for planetary studies, showing the morphological signatures of different volcanic types can be quite similar, and that caution is required when interpreting volcanic elongation and alignments in a tectonic context, the basement heritage must be considered as well as active tectonics.