**Uplift and Mantle Plumes**

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**Causes**

1. Dynamic Uplift
2. Hot Lithosphere Buoyancy
3. Lithosphere under-plating

**Uplift in Geological Record**

E.g. Tertiary North Sea

- Uplift from Dynamic Uplift and Lithospheric buoyancy, no evidence of under-platting (*Nadin et al 1997*)
- Average uplift 400m, maximum 900m
- Shows timing, location, and magnitude similar to that of the plume currently under Iceland
- Supported by sediment studies (*Mudge et al. 2004*) and petrology studies of volcanics (*Thompson 1974; Macleannan & Lovell 2002*).

**Uplift at Present**

E.g. Giant radiating dyke swarms

- Cause by plume impinging on lithosphere below
- Forming roughly circular mound with radial fracturing
- Dyke propagation, and influx of material sustain uplift

(*Ernst, R.E., et al. 1995*)

**Problems with Plume Uplift**

- Average sized plume of 1000m+ should produce equal amount of uplift in models (*Campbell & Griffiths 1990*)
- Some of the biggest igneous provinces show no sign of this pre-volcanic uplift e.g. Ontong Java Plateau, Columbia River Basalts, Siberian (*Czamanske, G.K., et al. 1998*).
Uplift which is seen in some LIPs is post volcanic (Ollier & Pain 2001); this however may have over-written pre-volcanic uplift.

**OJP Plateau and Iceland**

- Isostacy calculations show uplift form a plume of sufficient magnitude would have caused uplift between 1km and 4km depending on the model (Farnetani & Richards, 1994).
- Should have caused large amount of sub-arial volcanism.
- But as shown here only negligible amount are seen.

- Icelandic plume which is migrating east (Lawver, L.A., and Muller, R.D., 1994) should have made the western side thicker.

**Other Possible Causes**

- Changes in the stress field – e.g. crack propagation
- Geochemical changes – e.g. volume change
- Influx of magma – e.g. increase in volume due to magma injection

**Summary**

1. Pre-Volcanic uplift did occur but decays and is then over printed by subsequent more recent uplift.
2. Uplift never did occur and the plume model is false.
References


