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Constraining the vertical surface motions of the Hampshire Basin, south England During the Cenozoic

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The potential effect of rising sea level on the UK has received considerable attention in recent years. However, the ongoing long-term changes in surface topography of the UK driven by regional tectonics and the mechanisms responsible are not fully understood. It is thought that glacial loading/unloading is the primary influence. However, this is inconsistent with present-day vertical surface motions recorded from Continuous Global Positioning Stations (CGPS) across the UK. The lateral variations in the present day motions are too complex to be explained by glacial isostatic rebound. We are investigating the hypothesis that the vertical motions of SE England also reflect the long term tectonic history by backstripping the Cenozoic geological record. So far the Paleogene stratigraphic record of the Hampshire basin in southern England has been investigated and using a series of deep boreholes that reach the chalk basement, a 2-D backstripping method has been applied.

Subsidence analysis of cliff sections and boreholes reveal the Hampshire Basin was tectonically subsiding at a steady rate from 56.5Ma and any major periods of uplift and denudation to the present day state must have occurred from the mid Oligocene onwards. At this time the northern and western regions of the UK were believed to be uplifting as evidenced by heavy mineral transport directionns and sediment drainage patterns. A rapid increase in tectonic subsidence from 42Ma recorded by the three Isle of Wight sections in close proximity to an existing Variscan fault, thought to reactivate as a thrust during the Cenozoic, suggests a compressional stress regime in this region. The stress pattern observed from the tectonic subsidence data and evidence from drainage patterns supports a model in which the UK was uplifting in the north and west while the south east was subsiding. As this pattern is similar to the present day vertical surface motions and pre-dates glaciation, we propose glacial unloading as a mechanism for the observed return to a long wavelength tilting of the UK superimposed on short wavelength variations in surface topography caused by an existing state of tectonic stress, possibly inherited in the early to mid Cenozoic. Considering the tectonic and structural evidence available, the Cenozoic topography could be explained by magmatic underplating associated with north Atlantic opening and/or crustal buckling as a result of the Alpine collisional sequences.

Additional deep boreholes from the London basin and East Anglia provide a comprehensive 3D tectonic map of vertical surface motions during the early to mid Cenozoic. From this we may be able to understand more about the major tectonic controls influencing southern England at this time and what is modifying the current surface elevation change on short wavelengths.