Processes controlling the relationship between volcanic fronts and the subducting slab revisited

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Thus far a thorough understanding of the controls on the position of the arc volcanoes above the subducted slab has remained elusive. Recent work by England *et al.* (2004, *GJI*, **156**, 377) and Syracuse and Abers (2006, *G*[3], **7**, 5) explores global variations in depth to the slab below the volcanic front. England *et al*. find a systematic variation in depth to the slab, which they attribute to the product of the convergence rate of the slab and the angle of descent (Vsinδ). They conclude the downdip velocity (Vsinδ) likely controls the temperature structure in the wedge because as the downdip velocity increases, the rate at which hotter mantle is sucked into the nose of the mantle wedge increases. This observation, when combined with new experimental results on the H_2O-saturated melting of peridotite (Grove *et al.*, 2006, *EPSL* **249**, 74), provides a model to explain the location of arcs above the subducted slab. Grove *et al*. found the vapor-saturated melting curve for peridotite has a negative slope. Therefore as pressure decreases, temperature increases and the minimum depth of melting is limited by the maximum temperature in the shallowest - hottest part of the wedge nose. Thus, the negative slope of the H_2O-saturated peridotite solidus controls the minimum depth where melting can occur. Following this model, as the downdip velocity decreases: 1) the depth to the hottest point on the wedge nose is increased, 2) the volcanic arc is shifted away from the trench and 3) the depth to the slab is increased. The H_2O-saturated phase relations also predict that there should be a maximum cut-off depth for hydrous flux melting at ~135 - 150 km depth because the hydrous phases (chlorite and serpentine) present in the mantle wedge above the slab and within the slab have dehydrated by this depth. Arc volcanoes >150 km above the slab are therefore likely the product of adiabatic decompression melting, not hydrous flux melting.

DuneXpress, *in situ* analysis of interstellar dust

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Interstellar grains are messengers through space and time from the remote sites in which they formed and traversed in their journeys. Born as stardust with the elemental and isotopic compositions characteristic of the cool atmospheres of giant stars or of novae and supernovae explosions, they are subsequently modified in the interstellar medium. Interplanetary dust represents more processed material from comets and asteroids at different stages of Solar System evolution. DuneXpress will provide the capability to inter-compare between epochs of our cosmological history and our planetary history, via the study of the compositional variation and differences between interplanetary and interstellar dust particles.

The key to this treasure is dust astronomy. Dust astronomy requires a dust telescope in space to detect particles while accurately distinguishing their origins via their interstellar and interplanetary trajectories. Trajectory sensors utilize the electric charge signals induced when charged dust grains fly through the detector. These sensors, in combination with state-of-the-art in-situ dust impact detectors, are capable of determining mass, speed, physical properties and the chemical composition of individual dust grains in space.

The detailed objectives of DuneXpress are: 1. Mapping the seasonal interstellar and interplanetary dust flow. 2. Identification of the chemical and isotopic classes of cosmic dust grains. 3. Determination of the size distribution of interstellar dust. 4. To study the differences between interplanetary dust of cometary and asteroidal origin.

The DuneXpress spacecraft will be placed in a halo orbit at the L2 libration point of the Sun-Earth system, outside the Earth's debris belts. The spacecraft is three-axes stabilized and provides pointing of the dust telescope to better than one degree. The payload consists of dust telescopes, dust cameras and a plasma monitor. The total sensitive area of the dust instruments will be 1 m^2. The newly developed dust telescope consists of a Dust Trajectory Sensor (DTS) and a Large-Area Mass Analyzer (LAMA). LAMA consists of an impact target of 0.1 m^2 sensitive area. It performs time-of-flight measurements of ions generated by hypervelocity dust impacts onto the target. The device employs a reflectron in order to reach a mass resolution $M/\Delta M \geq 150$.

The mission costs less than 100 M€ and could be launched as early as 2013.