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Composition of bands in Argadnel Regio, Europa: Implications for Volcanic Resurfacing.

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Bands on Europa are dark or grey features which formed as a result of the pulling apart of cracks in Europa's surface, allowing new cryovolcanic material to be emplaced into the newly formed gaps. Bands have been shown to be sites of extensive resurfacing, and appear to have brightened over time, although the exact cause is not known. Thus the relative albedo of a band can be used as a proxy for age, as has been observed on Europa's surface, where the darkest bands crosscut, and are therefore younger than, lighter, or "grey" bands. We here combine Galileo Near-Infrared Mapping Spectrometer (NIMS) and Solid State Imager (SSI) data, using the methods of Shirley et al., [2010], to determine the surface compositions and water ice grain sizes of dark and grey bands in Europa's anti-Jovian Argadnel Regio, and to understand their relative histories.

Preliminary results show that the total amount of hydrated salts modeled in the grey bands tends to be less than that seen in the dark bands (from $\sim$19 to $\sim$38% and $\sim$38 to 47% respectively). One dark band contains hydrated sulfuric acid which is >5% lower than that of the surrounding ridged plains, as well as only 9% water ice of small grain size. These observations are interpreted as evidence that this band has been less processed by radiolysis, and so is relatively young or has been recently resurfaced. Relatively larger ice grain sizes are observed in the grey bands, as might be expected if they are older than the dark bands, and all the bands contain less large-grained ice than the surrounding ridged plains, thought to be the oldest unit on Europa's surface.

We also find a wedge-shaped band that exhibits a different composition across its northern part, and appears to have undergone resurfacing as the result of the formation of a large, shallow trough that cuts diagonally across the band. We speculate that this resurfacing could be due to processes such as (1) the removal of frost due to surface shaking during the tectonic event, resulting in lower albedo material being revealed; (2) the emplacement of fine-grained plume or similar material due to a cryovolcanic eruption on the wedge floor; or (3) because the fault forming the southwestern wall of the depression intersected a near-surface briny reservoir, such as has been suggested to exist on Europa, enabling low-albedo material to be emplaced onto the floor of the depression, thereby darkening the wedge and modifying its surface composition.

Reference: [1] Shirley J.H. et al. (2010) Icarus, 210, 358-384.