AGENOR HAS TWO EVIL TWINS: A GLIMPSE OF TECTONICS IN THE NORTHERN SUBJOVIAN HEMISPHERE OF EUROPA FROM JUNOCAM. G. C. Collins[1], P. M. Schenk[2], E. J. Leonard[3], C. J. Hansen[4], J. T. Keane[3], F. Tosi[5], M. Ravine[6], and M. Caplinger[6]. [1]Wheaton College, Massachusetts (gcollins@wheatoncollege.edu), [2]Lunar and Planetary Science Institute, [3]Jet Propulsion Laboratory, [4]Planetary Science Institute, [5]Italy National Institute for Astrophysics, [6]Malin Space Science Systems

Introduction: The close flyby of the *Juno* spacecraft past Europa in September 2022 enabled the JunoCam instrument to obtain images of the subjovian hemisphere, covering significant amounts of territory at better image resolutions than any previously available (see [1,2] for details). These images reveal a landscape of ridges, bands, arcuate troughs, chaos, and pits [3].

A particularly salient feature in the new images is a pair of bright bands that are seen at the terminator near 19°N and 39°N, striking to the northeast (Fig. 1a). The southernmost band of the pair is Corick Linea, also known as the “Evil Twin of Agenor” [4]. The central portion of Corick was observed at moderately low resolution in *Galileo* images, but this is the first time that the eastern portion of the feature has been resolved. The northernmost band of the pair is an unnamed bright band whose western portion can be seen obliquely and indistinctly in the *Galileo* image coverage. As with Corick, JunoCam images have also resolved the eastern portion of this band for the first time.

Both of the bright bands in the JunoCam observation appear to be stratigraphically recent (up to the limits of resolution). Corick is disrupted by a chaos area near the terminator, and the northern band is crosscut by one ridge and by the fractures of Kermario Fossae, but otherwise both of them crosscut all other tectonic features.

Tectonics of bright bands: Bright bands are rare on Europa, with only a few known examples [5]. The only bright band for which we have detailed Galileo images is Agenor Linea, in the southern antijovian hemisphere. Dilational bands are much more common, exhibit low or neutral albedo with respect to the rest of Europa’s surface, and their tectonic motions can be cleanly reconstructed by pushing the matching sides back together. Bright bands, by contrast, exhibit high albedo and irregular, non-matching edges that do not reconstruct. Analysis of the tectonics of bright bands indicates that they may form via contraction [4], or a combination of shear and contraction [6], or through multiple episodes of shear and extension [7].

One of the most convincing pieces of evidence that shear is important in the formation of Agenor Linea is the presence of a “horsetail” complex of faults at its eastern terminus. Tensile fractures known as tailcracks can form where a shearing fault terminates. Tailcracks angle out from one side of the terminus, as the material on that side tears away due to shear on the main fault. On Agenor, the tailcracks curve away to the south from the eastern terminus, indicating right-lateral shear along Agenor [8] (Fig. 2).

JunoCam imaging of the eastern termini of Corick Linea and the other bright band to its north shows that both of these bands also appear to terminate in horsetail complexes (Figure 1b). This observation adds more evidence to the hypothesis that shear is an important mechanism in the formation of bright bands. The tailcracks at the ends of both of these bright bands curves to the north, indicating that both of these bands have undergone left-lateral shear. Unfortunately, the resolution of the JunoCam images does not permit the same level of detailed structural analysis as was done for Agenor Linea.

Global symmetry: One of the reasons that Corick Linea was nicknamed as Agenor’s evil twin is that it is the most prominent bright band besides Agenor seen in *Galileo* imaging, and it coincidentally lies on almost the exact opposite side of Europa. JunoCam images show an even more striking mirror-image symmetry between Agenor and its two “evil twins.” Both of them show the opposite sense of shear from Agenor, and they have eastern termini near (30°N, 170°W) and (40°N, 155°W), very close to being antipodal to the eastern terminus of Agenor near (40°S, 0°W). Is this merely a coincidence, or should we look toward symmetries in the driving stresses behind Europa’s tectonics?

Hemispherical differences have been observed before in the dominant sense of strike-slip offsets (e.g., [9]), and such differences are predicted if strike-slip motions are driven by diurnal tides [10]. The three bright bands all strike generally east-west, where diurnal tidal models (with and without obliquity) would correctly predict right-lateral motion along Agenor and left-lateral motion along Corick and its neighbor.

A globally symmetrical stress state could also be induced by true polar wander (TPW), as has been proposed to explain the symmetrical, antipodal systems of arcuate depressions on Europa [11]. Agenor and Corick lie along the edges of the zones with the most tensile stress in the TPW scenario. Perhaps TPW helped to constrain where these bright bands could form, and diurnal stresses helped to constrain their motion. However, the JunoCam imaging as well as the *Galileo* E25DARKBP observation both show that the northern bright band is crosscut by the recent fractures of Kermario Fossae. Because Kermario is more closely tied to the TPW interpretation [12], this makes it less likely that bright band tectonics are driven by the same stress state.

Conclusion: JunoCam imaging of the eastern termini of Corick Linea and another bright band to its north reveals striking mirror-image symmetry with the almost-antipodal eastern terminus of Agenor Linea, indicating a global symmetry in the stress states that drove shear along these features, and in the strain response of Europa's ice shell to these stresses.

References: [1] Hansen, C., et al. (this meeting); [2] Schenk, P., et al. (this meeting); [3] Leonard, E., et al. (this meeting); [4] Greenberg, R., *Icarus* 167, 313-319, 2004; [5] Prockter, L., and G. W. Patterson, *Europa* (U. AZ Press), 237-258, 2009; [6] Prockter, L., et al., *JGR* 105, 9483-9488, 2000; [7] Hoyer, L., et al., *Icarus* 232, 60-80, 2014; [8] Kattenhorn, S., *Icarus* 172, 582-602, 2004; [9] Sarid, A., et al., *Icarus* 158, 24-41, 2002; [10] Rhoden, A., et al., *Icarus* 218, 297-307, 2012; [11] Schenk, P., et al., *Nature* 435, 368-371, 2008; [12] Schenk, P., et al., *GRL* 47, e2020GL088364, 2020.

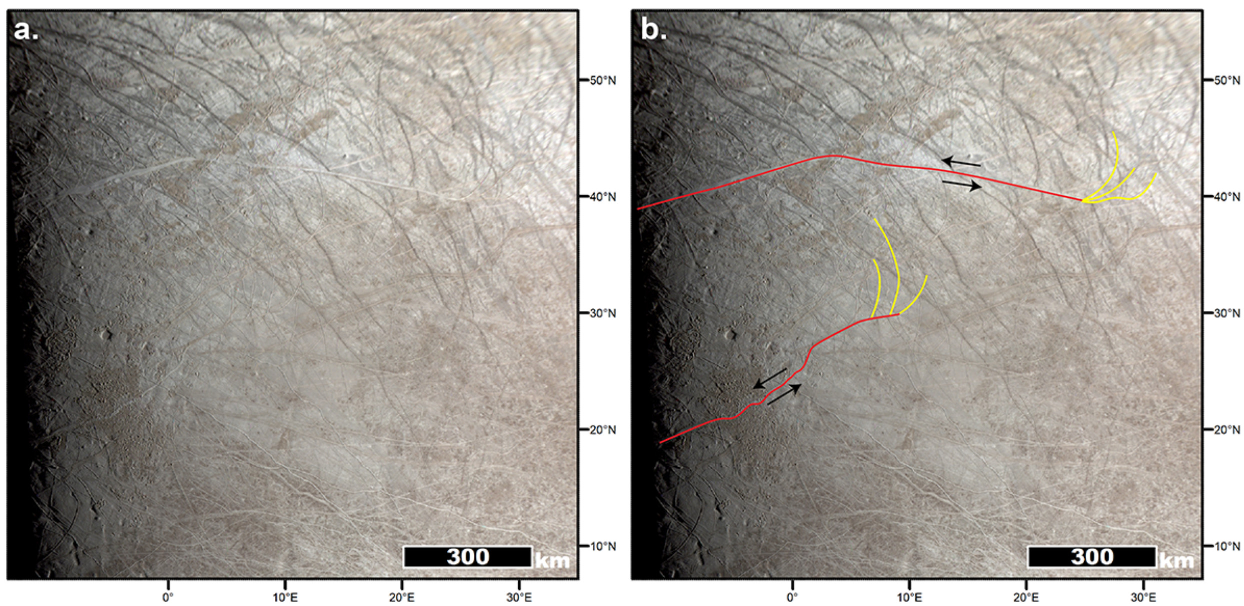

Figure 1. (a) JunoCam imaging of the eastern termini of Corick Linea and another bright band to its north. (b) Annotated interpretation of the bright bands (red), tailcracks (yellow), and inferred shear (arrows).

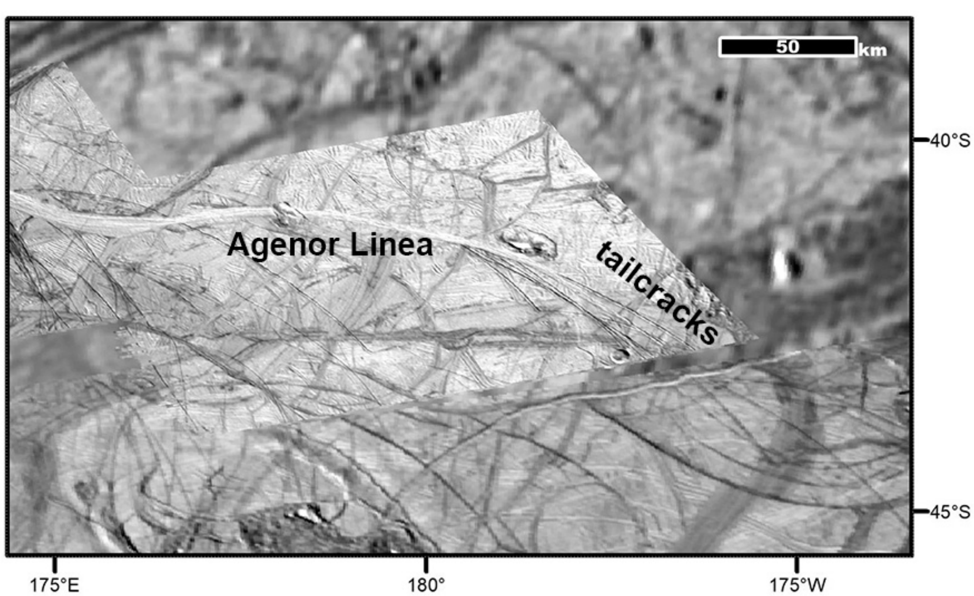

Figure 2. Galileo image of horsetail complex at the eastern terminus of Agenor Linea, after [7].