Europan Surface Ice Crustal Thickness

Author: Peter Nielsen
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Abstract: A "serm" interpretation of dimensional clustering of "crater" clusters apparent in band features of Europa indicates an 840m, ~1 km ice thicknesses of these dilational ice bridges at times of impacts. Europan Libya Lineal "complex, branching morphology" in one of these bands, is consistent with tidal shear strain genesis at a fault line produced by an encompassing impact "crater"/serm cluster. **Libya Linea evidently has good prospects for ice penetration by a robotic swimmer.** At bands, Gannymede's ice thickness is similar to Europa's. Callisto's ice thickness is evidently ~57.5 km

Keywords: Europa, Gannymede, Callisto, Earth, crust, space exploration, serm

Introduction

There is much interest in the crustal ice thicknesses of Europa and Gannymede, because of the idea of accessing possibly life-bearing oceans beneath their icy crusts.

Research has generally painted a discouraging scenario (Prockter & Pappalardo 2000, Turtle & Pierazzo 2001, Kerr 2001).

DISCUSSION

I have found, from studying "complex craters" for several years, that they are usually dimensionally clustered, consistent with crustal/mantle resonance "serm" genesis (Nielsen 2000-4).

The largest such serm is often twice the diameter of the second largest. Crustal thicknesses are thus evidently ¼ of such largest serm diameters.

Smaller, "higher order" serms have simple ratios also, similarly consistent with "serm" etalon resonance explanation, below and 3.08-11 (my ebook papers are so numbered).

Turtle and Pierazzo's Europan "craters" A, B, C, D, E, F thus evidently correspond to 2.1, 3.4, 4.6, 4.7, 5.1, 6 km ice thicknesses, corroborative of their conclusion that the ". . ice shell must have been more than 3 to 4 km thick . ."

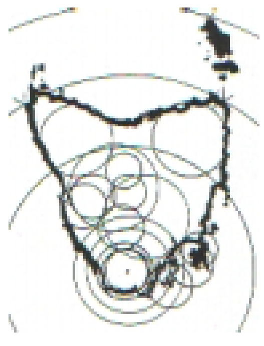

Fig 1: Tasmanian ½-ratio 1st and 2nd order ¼ -wave 55, 110, 65, 130, 85, 170 kd diameter serms. 1,000 kd 5 th order ¼ -wave mantle serm also indicated

SERM THEORY

My serm theory works well for all Solar System crustal surfaces, including the Earth's, all heavily impacted.

The Earth does not look cratered, as most other rocky planets do, because of a profound "Freeze Effect" associated with a recent, PTB super huge Impact Tectonogenesis (Nielsen 2002).

Freeze/Foraze Effect is my way of describing how, subsequent to super huge impact, ocean foam, geyser rainout, ocean water intrudes faster than magma into the numerous faultlines, 3.022.

The underlying theory has been confirmed by innumerable prediction-verifications.

SERMS

The ½ -ratio quality of largest serms is obvious in Tasmania as 55, 55, 55, 109 kd, 63.5 , 64, 65, 65, 65 , 66, 66, 67, 130, 130 kd and 137, & 79, 85, 170 kd crustal serms, Fig 1.

These ½ ratios are consistent with 1st and 2nd order ¼ -wave 3D cell resonances, that is with:

Horizontal S-wave coupled ¼ vertical S-wave crustal resonance genesis for the largest subserms and fringes, 2 S-wave coupled ¼ vertical S-wave resonance genesis for next smaller subserms.

PTB Impact serm crustal thicknesses in various parts of Tasmania were thus evidently: 27.5, 32.5, 42.5 km.

I have traced 100s of crustal serms for Tasmania, 100s of crustal and mantle serms globally, many more amongst the planets.

The overall Tasmania serm is evidently a 1,000 kd 5 horizontal wave ¼ -wave mantle resonance structure which grazes the Australian mainland at Philip Island.

The 2,000 kd China and 4,000 kd Antarctica serms are examples of dozens of terrestrial 2nd and 1st order ¼-wave mantle resonances defining prominent continent, ocean basins, my 1st (unmarketable) contradiction, 2000, of Continental Drift orthodoxy.

SERMS AS CRUSTAL THICKNESS INDICATORS

A dangerous excursion/distraction from my main task of explaining CONTINENTAL DRIFT CONTRADICTION, PTB Impact Tectonogenesis, a new geology, presentation of this Europan aspect of my work was shelved, 2002-4.

Showman & Malhotra (1999) have referred to an apparent paradox:

"The number density of small (<3 kd) craters on Callisto is less than on Gannymede, the reverse of the situation for larger (>10 kd) craters . . . the size of the impactors is not expected to be different for the two moons".

The paradox is resolved by acknowledging the "craters" as serms. Indeed, this observation is an important corroboration of my serm theory.

Serm dimensions are determined not so much by impactor size as crustal thickness, thicker on Callisto than on Ganymede.

Ganymede's containing few craters larger than 60 kd (Showman & Malhotra 1999), is consistent with a <15 km general ice thickness.

Callisto's 230 kd Asguard crater is most likely a ¼-wave resonance consistent with 57.5 km ice crustal thickness.

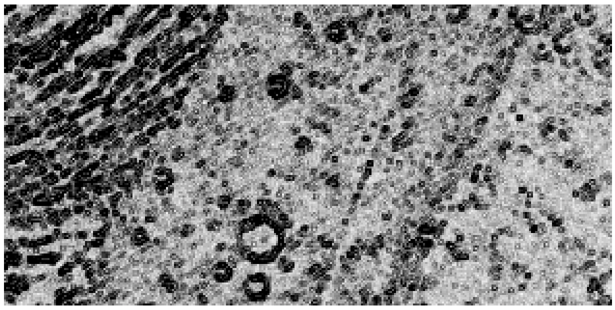

Fig 2: Gannymede's 26 km wide striated "lane" (band). Note ½ -ratio 1st and 2nd order ¼ -wave 4, 2 kd "craters".

Note how these increasing Jovian moon ice thicknesses are consistent with diminishing densities and tidal energisations with increasing remoteness from Jupiter.

Kerr (2001) argues that a 26 km wide feature on the surface of Gannymede is a rift feature, an idea I can corroborate via 4 kd, 2 kd serms in the middle of his picture, Fig 2, consistent with 1 km ice thickness.

Similar ½ ratio clustering in new and old bands in JPL (1999) 39 453 2478r (G8) image are consistent with 1.97 and 3.63 km ice thicknesses. The smaller of the ½ ratio serms have 9.5, 17.5 pixel ½ -diameters. Resolution is 207.4 m/pixel.

Similar ½ ratio clustering in JPL (1999) 55 244 3500r (G28) image are consistent with 2.97 km ice thickness. The smaller of the ½ ratio serms have 23.5 pixel ½ -diameters and resolution is 126.4 m/pixel.

There are many examples of ½ ratio clustering in other Gallileo photos of Gannymede. Many other Solar System serms show similar ½ ratio diameters happening too often to be a random coincidence.

EUROPA'S LIBYA LINEA

Prockter and Pappalardo (2000) mention that Libya Linea's "characteristics are different from those of most Europan troughs, which are linear and uniform in width"; a "prominent set of anastomosing troughs" with "a complex, branching morphology, and many exhibit terraces".

This complexity is inconsistent with having originated solely as "effects of tidal stress on an ice shell", the widely held explanation of Europa's "crisscrossing sets of double ridges" (Greenberg et al 2000).

As explained below, identical dimensional clustering of serms, into 20, 16, 13, 11, 10, . . pixel groups in both Libya Lineal and Astypalaea Lineal bands on Europa are consistent with an 840m ice thickness of both bands, co-genesis of both sets of diagnostic impacts and, much earlier, co-genesis of Libya Lineal and Astypalaea Lineal bands, paper 2.2.

IMPACT GENESIS

Impact evidently released tidal shear stress at Libya Linea, causing an impact serm/"crater" cluster bisectional faultline (serbil) to open, consistent with shear strain of very salty water ice 840m, say 1km thick.

Shear strain of Europan ice is clearly visible in surrounding small faultlines, most obviously in the faultline through the large "crater" and where the Libya Lineal faultlines are continued.

The two faint lines crossing from the lower right are almost certainly relatively new tide cracks. Most other features however, are consistent with Libya Lineal impact+shear strain genesis:

- "Craters", most of which have been obscured by
- Floods centred on Libya Linea, evident as band "grain" obscuration,
- Irregularly branching faultlines,
- White frost maxima tellingly adjacent to: plausible shear strain maxima, newest, thinnest ice.

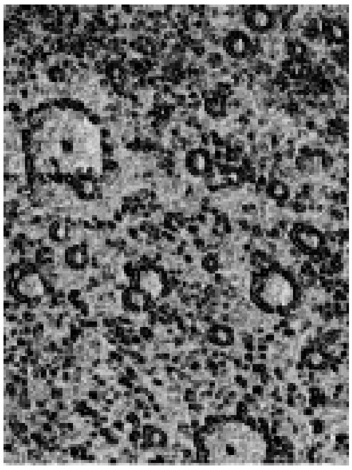

Fig 3: Callisto's much higher order 11 kd and smaller "craters". These look more random only because of their relatively high horizontal wave resonance orders. Many of Earth's landscapes, mountains, hills, rivers, creeks and so on, are evidently produced by similarly high order crustal serm resonances (Nielsen 2002).

The absence of recent convergence features in the Libya Lineal region, so ubiquitous globally as double ridges (next paper), is consistent with:

- Europa's "complex maze of overlapping surface features" (Prockter and Papparlardo 2000) having originated in the aftermath of super huge impact genesis/renewal of the Europan ocean, 2.2,
- Relatively recent Libya Linea genesis,
- Good prospects for subcrustal ocean exploration at the "White frost maxima tellingly adjacent to: plausible shear strain maxima, newest, thinnest ice", 2.3.

BAND ICE THICKNESSES

"Crater" diameter dimensions in the band occupied by Libya Linea, in the JPL (1999) 17ESLIBLIN01, 46 666 9939r.gif image, are clustered into 20, 16, 13, 11, 10, . . pixel groups.

Easily explained in serm terms, such clustering is unlikely to have happened randomly and is otherwise inexplicable. There are two 10-, two 11-, four 13-, four 16-, and two 20-pixel "craters".

That there are clearly three clusters between the ½ -ratio 10- and 20-pixel "craters", of 16, 13, 11 pixels, strongly indicates that the ½ -ratio "craters" are 8th and 4th –order serms, the 11-, 13-, and 16-pixel serm clusters 7th, 6th, 5th -order serms.

Image resolution is 42m/pixel (Prockter and Papparlardo 2000). 20, 16, 13, 11, 10 pixel clusters thus correspond to 840, 672, 546, 460, 420m diameters; 840, 672, 560, 480, 420md “craters” corresponding to 4, 5, 6, 7, 8 horizontal wave coupled ¼ -vertical wave resonant serms.

4 horizontal wave resonance of 840m wide serms corresponds to 840m ice thickness.

Identical serm dimensional clustering of the band of Astypalaea Linea, LHS of 46 666 0100r, indicates 840m ice thicknesses of both bands at respective times of impact, probably the same shower.

Viewed at a greater emission angle (~45^o) than Libya Linea (~20^o), the Astypalaea Linea serm numbers are plausibly identically clustered: two 10-, two 11-, seven 13-, one 16-, two 20 -pixel “craters”.

The strong dimensional clustering of Europan and Gannymede (Fig 2) crater-scapes can be compared to the more random-looking resonances of Callisto’s smaller, higher order “craters”, Fig 3.

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