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Recent thinning of the Fletcher Promontory Ice Rise indicated by oversized Raymond bumps

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The DELORES low frequency ice-penetrating radar was deployed on the Fletcher Ice Rise, Ellsworth Land, Antarctica in the Austral Summer 2005-6. Extensive surveys were made around the Triple Junction, where three divide ridges meet. Radar at 4Mhz detected isochronic layers throughout the ice thickness of approximately 600m. These layers showed typical anticlines under the divide ridges, commonly referred to as 'Raymond Bumps', arranged on top of one another to form 'Raymond Stacks'. In common with other bumps in this areas, but nowhere else, the bumps contain double maxima ('double bumps'). GPS surveys showed the shape of the triple junction to be a 'droplet' form in the vicinity of the Triple Junction, with ridges emanating from this droplet. Raymond stacks were found underneath the central droplet, even though there was no strong ridge. Underneath the ridges, the Raymond bumps maximum amplitude (˜200m) was 30% of the thickness of the ice. These are the largest Raymond bumps expressed as a fraction of ice thickness found so far, and they are nearly as large as those found under the much larger Hercules Dome (Jacobel and others, 2005). Thermo- mechanically coupled finite-element modelling shows that the Raymond effect is not quantitatively strongly dependent on the thickness of the ice, and bump amplitude therefore scales with thickness. Consequently, such large bumps must either be due to a highly anomalous ice rheology in the Fletcher area, or be relicts of a time when the ice was much thicker. Modelling is used to show that the ice would have had to have been around twice as thick to create these bumps, and that the thinning must have happened in the past few thousand years. This presumably occurred as a result of large scale thinning of the Rutford ice stream and Carlson Inlet, indicating late deglaciation of this area of the Ronne ice shelf, and raising questions about the contribution of secular forcing to the thinning of Pine Island glacier.