Morphology and gravitational processes on the Canadian Beaufort Continental Slope

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Hydrographic and high resolution seismic surveys of the Beaufort slope have revealed the presence of two characteristic slope morphologies. A 50 km length of the slope is characterized by a prominent shelf-edge escarpment and hummocky seabed morphology with numerous hyperbolic refectors. This part of the slope has suffered large-scale gravity sliding, possibly as a single, very large mass-movement. The slope to the east of this escarpment is characterized by a smooth seabed morphology, unusually high acoustic penetration revealing well-stratified sub-bottom reflectors and areas where seabed and sub-bottom reflectors are disrupted by dipiric features. From detailed studies of this eastern slope area, several lines of evidence suggest the importance of relatively slow, but continuous creep of the slope sediment pile. Part of the upper slope has been downfaulted into a narrow graben, indicating a regional tensional regime. Diapirs are preferentially located along the bounding graben faults. Downslope of the graben, numerous small normal growth-faults are associated with syn-sedimentary folding. Some faults show evidence for later reverse movements along normal growth-fault planes. These data indicate that both tensional and compressional forces have been active and support the model of creep deformation. The 40 cm thick stratified sequence is though to have moved slowly downslope over a basal chaotic zone. The stepped-nature of the basal zone, reminiscent of the décollement zones of thrust sheets suggests that the deformation occurred in part during the creep movement. Creep is an important process because it may lead to premature failure under loading such as by earthquakes or storm waves.