

※ 注意：請於答案卷上依序作答，並應註明作答之部分及其題號。

第一部分：請翻譯下面段落

(1) To understand how climate change comes about, and what the future may hold, we need to untangle the linkages between ocean circulation and the productivity of phytoplankton. Productivity depends on nutrient availability in the ocean and, as phytoplankton is leading players in the global carbon cycle, they partly determine levels of the greenhouse gas carbon dioxide in the ocean and atmosphere. (25%)

(2) Submarine hydrothermal springs at mid-ocean ridges emit hot, anoxic fluids which mix turbulently with ambient sea water as they rise from the sea floor, precipitating various sulfide and oxide phases, until some level of neutral buoyancy is attained hundreds of meters above the sea floor. Resultant plumes are then dispersed along isopycnal surfaces where they can be readily detected from their strong enrichment in dissolved chemical tracers and increased suspended particulate load. (25%)

第二部分：請簡述文意，並挑出幾個關鍵字詞 (keywords)。選擇以英文或中文作答均可，簡述文意部分，逐字翻譯或抄錄均不予計分。

(1) Decreased stability of methane hydrates in marine sediments owing to phase-boundary roughness (25%)

Below water depths of about 300 meters, pressure and temperature conditions cause methane to form ice-like crystals of methane hydrate. Marine deposits of methane hydrate are estimated to be large, amassing about 10,000 gigatons of carbon, and are thought to be important to global change and seafloor stability, as well as representing a potentially exploitable energy resource. The extent of these deposits can usually be inferred from seismic imaging, in which the base of the methane hydrate stability zone is frequently identifiable as a smooth reflector that runs parallel to the sea floor. Here, using high-resolution seismic sections of seafloor sediments in the Cascadia margin off the coast of Vancouver Island, Canada, we observe lateral variations in the base of the hydrate stability zone, including gas-rich vertical intrusions into the hydrate stability zone. We suggest that these vertical intrusions are associated with upward flow of warmer fluids. Therefore, where seafloor fluid expulsion and methane hydrate deposits coincide, the base of the hydrate stability zone might exhibit significant roughness and increased surface area. Increased area implies that significantly more methane hydrate lies close to being unstable and hence closer to dissociation in the event of a lowering of pressure due to sea-level fall.

接背面

(2) Tsunami hazard from submarine landslides on the Oregon continental slope (25%)

The morphometric analysis of submarine landslides on the continental slope of Oregon provides insight into tsunami hazard, including the locations of mass movements, the sizes of mass failures, their relative importance to the structure of a given margin, and the potential for landslide-generated tsunami hazards. Numerous, often overlapping failures, including two super-scale slumps in the southern Oregon margin, may have had the capacity to produce very large tsunamis, and should be considered when assessing earthquake and tsunami hazard in the Cascadia Subduction Zone. We use various aspects of the slides, including the mean water depth, width, run-out distance, and thickness, along with the slope gradient in the scar and adjacent slopes (and radius of curvature of the failure plane for slumps) to predict maximum tsunami amplitudes directly above the failure. Cohesive landslides tend to have higher headscarps than the slides that lose cohesion, suggesting that they occur in stronger sediment, and have the potential to produce larger tsunamis. On other continental margins (California, Texas/Louisiana, and New Jersey/Maryland), landslides tend to occur on slopes less than 4° , however offshore Oregon, most of the landslides occur on slopes over 15° ; the failures on the steeper slopes tend to produce larger tsunamis. There are surprisingly few large failures along the seismically active northern margin, implying that strong shaking maybe limited in this region, and tsunami generation may be due to coincident movement along faults on the upper plate.