ance shows that little strain is accumulating, compared with that to be expected were the two converging plates strongly locked together. The shortening of trilateration line lengths on the overriding plate in the direction of convergence is much less than expected for a mechanically locked plate contact, and subsidence is observed where a simple dislocation model predicts uplift (J. C. Savage, US Geological Survey, Menlo Park, California). Other measurements of vertical deformation also suggest that slip is mostly aseismic (J. Beavan, Lamont-Doherty Geological Observatory). Finite-element modelling with a visco-elastic rheology indicates that only about 15 per cent of the slip takes place seismically (R. Dmowska, Harvard University). This lack of accumulating strain casts doubt on the seismic potential of the Shumagin segment.

Perhaps the best hope for improving our understanding of earthquakes comes from integrated studies in particular regions. One promising area discussed at the conference is the Prince William Sound region, near the epicentre of the 1964 Alaskan earthquake, at magnitude 9.2 the second-largest recorded earthquake. The combined results of detailed seismicity studies, geodetic measurements and regional seismic sounding indicate that at least part of the megathrust (the major interplate boundary), which slipped tens of metres in 1964, is now seismically silent and presumably locked, accumulating strain. The distribution of slip in the 1964 event determined from bodywave seismograms (D. Christensen, University of Alaska, Fairbanks) agrees with that determined by inversion of geodetic data (S. R. Holdahl, National Geodetic Survey), and identifies two large regions of high slip beneath Prince William Sound and Kodiak Island.

Crustal structure in the Prince William Sound region has been imaged with seismic reflection and wide-angle reflection/refraction profiles from the Trans-Alaska Crustal Transect[4] (TACT). A prominent, gently-dipping velocity jump, inferred from strong reflected and refracted arrivals, has been interpreted as the megathrust, in view of its depth, regional extent and relation to the location and stress orientation of seismicity in the downgoing plate. Carefully located seismicity, monitored with a regional network, occurs mainly in the upper 10 km of the subducting plate, whereas the megathrust is nearly aseismic (R. A. Page, US Geological Survey, Menlo Park). The observation that coseismic vertical deformations have been partially recovered in the post-earthquake period suggests that the interplate contact is locked[5]. The absence of aftershocks larger than magnitude 5.0 beneath Prince William Sound after the 1964 earthquake suggests that the interface locked quickly. The seismicity in the subducting plate reflects downdip tensional deviatoric stress, consistent with a locked fault zone, and is spatially continuous with deep subduction-zone seismicity (Page). The seismicity, TACT results and regional tectonics indicate that the megathrust lies between the overriding plate and the subducted Yakutat terrane, which appears to be sutured to the top of the Pacific plate[4] (see figure).

The seismic quiet on the Alaskan megathrust beneath Prince William Sound strengthens the case that the Cascadia subduction zone, 1,600 km further south, is also threatened by a great earthquake — a matter of concern for the 10 million people living in the region. Coastal geology strongly suggests that great Cascadia earthquakes have occurred in the past few thousand years (B. F. Atwater, US Geological Survey, Seattle). Moreover, strain measured geodetically suggests that a mostly offshore part of the plate boundary is now locked[6]. These findings have seemed inconsistent with the seismic record, which contains virtually no subduction interface earthquakes of any size in the twentieth century except for the Petrolia sequence in northern California in April this year. But the seismic quiet beneath Prince William sound since 1964 shows that this absence of interplate earthquakes need not contradict the hypothesis of past great earthquakes on the Cascadia subduction zone. The geological evidence for these includes studies of coastal marshes submerged by regional coseismic downdrop and suggests significant variability in earthquake size and recurrence in Cascadia too (Atwater).

The variability that currently hinders earthquake forecasting may spur development of real-time warning systems for earthquakes and tsunamis[7]. Such systems might allow critical facilities, such as power plants, to be shut down moments before being struck by seismic or oceanic waves, and could help in rapid damage assessment afterwards □

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DAEDALUS

Warm feelings

Most people have an ambivalent attitude towards heat energy, especially when expressed in calories. They are great consumers of calories in fuel, but hate and fear them in food. Many householders grimly endure a thin, joyless starvation diet prepared in a tropically overheated kitchen.

Daedalus now points out the obvious escape from the contradiction. The householder should keep warm by generating more metabolic heat. This would simultaneously reduce heating bills and burn off the accumulating body fat. Sadly, the human body normally increases its metabolic rate only in response to thoroughly unpleasant stimuli, such as pain, cold or exercise. But Daedalus notes a minor benefit of alcohol: it dilates the blood vessels of the skin. It gives the drinker a warm glow, but by the same effect increases the rate at which heat is lost from his body. His internal reserves of energy can be depleted very rapidly. The Saint Bernard with the brandy cask is actually quite a hazard to the snowbound traveller.

Alcohol, of course, has drawbacks as well as benefits. It has a calorific content of its own, for example. So DREADCO biochemists are seeking a substance that brings the blood to the skin without supplying calories or making you drunk. They remark that alcohol is a slow-acting anaesthetic. Some other anaesthetics can also increase the metabolic rate. Certain high explosives, like dinitrophenol, also do this: and nitroglycerine is used as a drug to relax the arteries of coronary victims. The DREADCO team is accordingly combing the ranks of anaesthetics, high explosives, and even high-explosive anaesthetics, in search of the ideal heat-loss agent. Even if they don't find it, they may pick up enough clues to enable them to synthesize it. It will bring blood to the skin with a minimum of side-effects, giving the user a sense of warmth and comfort even in the coldest house, while burning up food calories at an unprecedented rate.

DREADCO's 'Body Heat' ® should find a wide and grateful market. Its happy users will permanently radiate a warm, enticing, healthy glow. They will be able to tuck into a steady diet of fatty, sugary pies and pastries, while maintaining an enviably slim and elegant figure. They will be able to flaunt that figure in the thinnest and flimsiest of fashionable clothing without have to heat their environment to boilerhouse levels to stay comfortable. The only snag is that their raised metabolic rate may 'burn them out' sooner. But with the ranks of geriatrics already swelling ominously, even this may be an advantage.

David Jones

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