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BOTTOM SEDIMENT ALONG OIL SPILL TRAJECTORY IN PRINCE WILLIAM SOUND AND ALONG KENAI PENINSULA, ALASKA

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Chapter F. Conclusions and recommendations regarding Prince William Sound oil spill

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CONCLUSIONS AND RECOMMENDATIONS REGARDING PRINCE WILLIAM SOUND OIL SPILL

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Ever since the last retreat of large glaciers extending onto the shelf opened ice-sculptured Prince William Sound to allow the sea to enter, this fjord complex has trapped most sediments supplied from surrounding glacio-fluvial drainage systems. Deposition on the adjacent continental shelf and extending down-drift along the Kenai Peninsula, therefore, has been largely terminated, except for areas under the influence of the Copper River. A few steeply sloping, prograding fjord-head deltas exist within the sound, but the dominant post-glacial deposits are sub-horizontally stratified ponds of fine sediment confined to the deepest portions of tributary fjords and the sound proper. Sparse beach deposits are perched locally near sea level along the fjord walls, but the walls below are kept bare of and are by-passed by sediments settling from suspension.

This general setting is the scene of the worst U. S. oil spill to date. One might assume that some of the oil that was so damaging to life on the sea surface and over beaches and intertidal areas would ultimately be incorporated along with natural sediments in local deep-water sinks. Our sampling effort focused on possible sediment sinks of Prince William Sound near the most severely polluted surface areas. Our analytical procedures were designed to determine sedimentation rates in the sinks, on detecting traces of hydrocarbons related to the spill, and on any effects on benthic life. Rapp et al (this volume) consider station 15 as being most suspect of low level oil pollution among all the samples analysed, but their results are equivocal. Foraminiferal studies by Quinterno (this volume) find nothing unusual at this particular station, but suggest low-oxygen faunas at several other sites (7,8,9,10, see figure 1, Chapt. E) as being potentially suspect of influence by the oil spill. Regional patterns of sediment respiration rates measured by Grebmeier (this volume), and thought to be reduced initially due to the smothering influence of any oil on benthic organisms, also did not show a clear correlation with the other facets of our investigation that would indicate areas of possible pollution. Furthermore, areas with highest present deposition rates would also be the most likely depositories for petroleum products. According to studies by Grebmeier (this volume) station 2 (Fig. 1, Chapt. C) with the highest ^{7}Be counts should be a site of rapid deposition and therefore a site of most immediate pollution. The hydrocarbon analyses by Rapp et al (this volume) show nothing anomalous at this site. Thus, the results are essentially negative. At the time of the field operation the deep-water sediments sampled held no clear record of the oil spill. These surprising results raise important questions.

The box corer used at nearly all sampling sites is well-suited to preserve the surface fluff blown away by other sampling devices, and the brown surface ooze seen in most cores indicates that sedimentary particles settling onto the sea bed most recently were in fact retrieved and analyzed. At deposition rates of about 3 mm/yr, earlier determined through ^{210}Pb studies by Klein (1983) and here confirmed by Bothner (this volume) with similar techniques, some post-spill particles should already have been included in the surface ooze at the time of sampling. However, Payne et al (1989) found no evidence for combined hydrocarbons/suspended particle flux in the water column of Prince William Sound soon after the spill, even near surface slicks of fresh, rather low-viscosity oil. Perhaps too little time had elapsed between the spill and our sample collection to allow for oil densification and settling through the weathering process. Or, is it possible that the bulk of the oil spilled in this natural sedimentary depocenter separated from the bulk of the natural particle flux to travel in the Alaska Current to distant environments with effects that will become evident later? From studies of an oil spill in Massachusetts, Sanders et al. (1980) reported the presence of oil in sediments and effects on biota for up to 5 yrs following the spill. Knowing where these effects will be is not only important for the Exxon Valdez spill, but also for future accidents, as similar crude oil will be hauled through this high latitude, cold-water setting with strong tidal currents and ice-berg hazards for many years to come.

RECOMMENDATIONS

We recommend that new studies in Prince William Sound begin in 1990 to learn of the fate of oil presently still polluting the rim. Previously, Boehm et al (1987) monitored a controlled oil spill by studying samples extending from the intertidal areas to 35 m water depth. From this study we know that offshore hydrocarbon levels increased for three years. Thus, we can expect some pollution of deepwater sinks with time after the Exxon Valdez oil spill. The proposed studies would extend downslope from the heads of several heavily polluted coves, that are being monitored by ongoing programs, to learn of the transport of weathered oil to the nearest deep-water sink, and of its deposition there. The choice of study transects should consider that some oiled beaches were steam-cleaned repeatedly, and that the sinks adjacent to such flushed beaches may show different levels of pollution than sinks off untreated beaches. These studies would also re-occupy several of our previously sampled sites to learn more about the timing and rate of deposition, the degradation, and the mixing of weathered oil by burrowing organisms. This sampling should be repeated the following season and perhaps longer, depending on the findings. We further recommend a long-range reconnaissance to distant potential depocenters along the Alaska Peninsula.

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