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The dangers of oil pollution on the Great Barrier Reef. Submission to the Australian senate select committee on off-shore petroleum resources. Queensland Littoral Society, pp. The interactions of diversity, distribution and mode of reproduction among major groupings of the deep-sea benthos, pp. Species diversity, genetic variability and environmental uncertainty, pp. Methods for studying the effects of marine oil spills. Background information for ocean affairs board workshop on: Iiputs, fates, and effects of petroleum in the marine environment, Airlie, Virginia. Biology and Geology of coral reefs, vol. Academic Press, New York. Life histories and the role of disturbance. Opportunistic life histories and genetic systems in marine benthic polychaetes. Pattern and zonation-study of bathyal megafauna using research submersible Alvin. Slow growth rate of a deep-sea clam determined by Ra chronology. Deep-sea research by manned submersibles. Sibling species in the marine pollution indicator Capitella Polychaeta. Similarity measure sensitive to contribution of rare species and its use in investigation of variation in marine benthic communities. Slow recolonization of deep-sea sediment. Temporal adaptations in sibling species of Capitella, pp. Ecology of the Marine Benthos. Baruch Library in Marine Science No. Sampling properties of a family of diversity measures. Life histories and genetic variation in marine benthic organisms, pp. Plenum Press, New York. Benthic communities in experimental ecosystems and the effects of petroleum hydrocarbons. Diversity and population dynamics of benthic organisms. Galapagos Biology Expedition Participants. Initial findings of a biology quest. Faunal changes with depth in the deep-sea benthos. Ambio, Special Report, No. Introduction to the symposium: Cycllpodia from a deep-water polychaete west of Ireland. Confidence intervals for similarity measures using the two sample jackknife. Measures of diversity with unbiased estimates, pp. Ecological Diversity in Theory and Practice. Diversity as an indicator of pollution: Trophic interactions in experimental marine ecosystems perturbed by oil, pp. In situ studies of deep-sea communities, pp. Advanced concepts in ocean measurements. Baruch Library of Marine Science No. Quantitative studies of macrofauna in three benthic communities in experimental ecosystems. Anatomy of an oil spill: Processes and interactions, pp. Advanced concepts in ocean measurements for marine biology. Response of benthic communities in MERL experimental systems to low level, chronic additions of 2 fuel oil. The biology of hydrothermal vents: Replication in controlled marine systems: Marine mesocosms, biological and chemical research in experimental ecosystems, Springer-Verlag, New York. Introduction to the biology of hydrothermal vents, pp. Animals in soft sediments near hydrothermal vents. The utility of studying the effects of pollutants on single species populations in benthos of mesocosms and coastal ecosystems, pp. Recovery of a polluted estuarine system: Subtidal macrobenthos of Narragansett Bay. Field and mesocosm studies of the effects of eutrophication and organic input on benthic populations, pp. Marine biology of polar regions and effects of stress on marine organisms, John Wiley and Sons, New York. Deep-sea fauna of sediments in the vicinity of hydrothermal vents. The ecology of deep-sea hydrothermal vent communities. The marine environment of the U S. Atlantic continental slope and rise, Jones and Bartlett Publishing Inc. Macrofaunal colonization of disturbed deep-sea environments and the structure of deep-sea benthic communities. Variability of the Benthic fauna, II. The seasonal variation, , pp. A plethora of unexpected life. The effect of plant material on a benthic community of the Bermuda continental slope, pp. Global venting, midwater and benthic ecological processes. National Undersea Research Center Report Life history and recolonization among agglutinated foraminifera in the Panama Basin. Tidal effects on temperature measurements in diffuse hydrothermal flow from Guaymas Basin. Feeding biology of the Mid-Atlantic Ridge hydrothermal vent shrimp: Species diversity in deep-sea communities. Impacts of exploratory drilling. Additional notes on deep-sea hydrothermal vent and cold seep soft-sediment communities, pp. Hydrothermal vent fauna of Escanaba Trough Gorda Ridge , pp.

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2: Global venting, midwater, and benthic ecological processes / - CORE

*Global Venting, Midwater, and Benthic Ecological Processes [Ivar Babb, Michael De Luca, Undersea Science Symposium] on www.enganchecubano.com *FREE* shipping on qualifying offers. This work has been selected by scholars as being culturally important, and is part of the knowledge base of civilization as we know it.*

Page 42 Share Cite Suggested Citation: Future Needs in Deep Submergence Science: The National Academies Press. Yet when compared to the vast distances involved in space, the deep ocean lies essentially at "our back door. Fundamental contributions to the understanding of processes responsible for plate tectonics and ocean chemistry and physics, as well as the origins of life and mechanisms for speciation, have been made by scientists working at depth in the ocean. There is reason to believe that further discoveries can be expected if ad- equate access to these regions can be provided. In the mids, during an investigation of geothermal plumes of water along a mid-ocean ridge spreading center of a tectonic plate, a com- pletely unique community of life forms was discovered Corliss et al. Hydrothermal vents, with their unique chemosynthetic communi- ties and with their chemistry profoundly impacting ocean chemistry, are among the most important discoveries of the twentieth century. Public com- ments received during the course of this study from human occupied ve- hicle HOV and remotely occupied vehicle ROY users further identify areas of inquiry with significant scientific potential. Examples of some of the comments received that pertain to deep submergence science are found in Box Deep submergence science is a diverse field of study involving bio- logical, chemical, geological, and physical oceanography, as well as ma- rine archaeology. Habitats range from the vast midwater environments Figure to the ocean floor; from continents to the depths of the ocean basins; from plate boundaries at spreading ridges and ocean trenches to the remains of ancient and recent civilizations. The diverse nature of deep submergence science necessitates the use of a mix of expertise, ap- proaches, platforms, and tools. The ocean margins and ridges are ideal global laboratories to study dynamic interactions among physical, chemical, and biological processes. Submer- gence science provides a powerful way for conducting important research in the geosciences and biological sciences. The subsequent sections dis- cuss only a few examples of the most compelling scientific challenges that call for access to the ocean depths. For example, these findings will lead to a better understanding of interactions between the hydrological regimes in ocean margins and the consequences for earthquakes, slope stability, arc volca- nism, ocean chemical balances, the global carbon cycle, clathrate hydrate formation and dissociation, ocean resources e. Cold seeps, mud, and serpentine dippiest and the associated chemosynthetic ecosystems were discovered with submersibles, and the great majority of what is known about this new frontier of science was obtained from the use of deep submergence vehicles. In the late s, scientific understanding of how Earth works was completely revolutionized by the newly accepted concept of plate tecton- ics and seafloor spreading. The surface of Earth consists of vast, rigid, lithospheric plates that are in relative motion. The driver of plate move- ment resides at depth, in the mantle. Large convection cells result in the slow motion of the mantle in the solid state. The mantle rises beneath mid-ocean ridges, melts, and erupts to form new ocean crust. The 60, km-long mid-ocean ridge system is therefore the location at which plates are generated. Newly created seafloor spreads at rates on the order of 1 to 20 cm per year. The seafloor generated at mid-ocean ridges covers two- thirds of the planet. Old seafloor is consumed at subduction zones, where two adjacent plates moving in opposite directions meet. The denser plate bends and plunges into the mantle, while the overriding plate is com- plexly deformed. At these convergent margins, the subduction of a plate causes differential partitioning of strain and generates earthquakes and volcanism. It is accompanied by dehydration reactions that release fluids, generating partial melting and thus, abundant magmatic activity. Eventu- ally, the subducted plate is recycled into the mantle. Due to its constant renewing, the age of the oldest intact oceanic crust, located in the western Pacific, does not exceed million years, and is therefore very young compared to the age of Earth. This new concept was built on the visionary hypothesis of continental drift proposed by Alfred L. Wegener at the beginning of the twentieth century to explain the match in shape and geological structure of continents across an ocean such as the Atlantic. In the plate tectonic scenario, continents do not drift but are anchored in the plate and en- trained with it. However, because they are less dense than the ocean crust, i"Diapir" refers to a general class of geologic structure that occurs when a lower-density layer of material is overlain by a higher-density layer of material. Salt domes are a classic example, as are shale diapirs and mud volcanoes. Consequently, the distribution of continents has changed during geological times. The initiation of plate rifting results in continental breakup: The open- ing of a new basin eventually results in the closure of an older one and the collision of two continental masses. This process has occurred many times in the past and resulted in the building of successive mountain belts that have been subsequently eroded. At present, the closure of the Tethys ocean basin is responsible for the building of the Alps and the Himalayas. A basic principle of plate tectonics is that plates are essentially rigid and do not deform. Therefore, most of the active areas are located at plate boundaries, where the plates are either constructed mid-ocean ridges or consumed trenches associated with subduction. Another essential im- plication is that because these areas are located underwater, the under- standing of processes governing plate tectonic requires exploration, mea- surement, and sampling of the seafloor. Among the various ways of investigating the seafloor, direct approach has proved to be critical. Mid-ocean ridges, passive and active plate margins, and hot spots are the key areas. Their investigation has benefited by, and still requires the use of, submersibles. All of the work accomplished at sea during the last 30 years has contributed to verifying the concept of plate tectonics. There are still a number of processes, however, that are not fully understood. Mid-ocean Ridge Processes With the widespread acceptance of plate tectonic theory, the value of direct observation of the seafloor became obvious to the whole scientific community. The next major step was the discovery of active hydrother- mal vents at the end of the s. These vents result from seawater convection cells that are activated by magmatic heat, either from magma chambers located beneath the ridge or from cooling magmatic rocks. This has been made possible through the development of instru- ments associated with submersibles new types of samplers and sensors. It is clear that mid-ocean ridges function as systems; the aim now is to understand the linkages between what is happening in the mantle, the nature and distribution of RIDGE biospheres, and ultimately the compo- sition of seawater. To answer this fundamental ques- tion, multidisciplinary experiments must be conducted at specific sub- merged locations. This has led the program to select a limited number of sites that represent the entire spectrum of ridge types: In these sites, coordinated, multidisciplinary experiments by geolo- gists, geophysicists, chemists, biologists, and oceanographers will require long-term monitoring to determine their temporal and spatial evolution. Some of these "integrated study sites" have already been selected by the community while others are still under discussion, but it is obvious that all will be at depths shallower than 4,m. Because of improved research techniques these studies will require repeated cruises and more submers- ible time to conduct experiments and to deploy and recover instruments on the seafloor. Logistically, some of the selected sites Juan de Fuca Ridge, East Pacific Rise are located within the areas where Alvin normally works. The Lau basin, however, in the western Pacific, is very far away. What are the forces and linkages that determine the struc- ture and extent of the hydrothermal biosphere? These questions require submersibles to conduct detailed surveys and sampling programs, as well as long-term monitoring. Fluid is carried into subduction zones, both trapped in the pores of sediment and rocks and bound in hydrous miner- als. The fate of the fluid varies from location to location e. Oliver, ; Langseth and Moore, ; Peacock, ; Kastner et al. At about half of all convergent margins, most of the sedi- ment carried into the subduction zone is detached and added to the over- riding plate to form an accretionary prism. Rates of fluid flow through these prisms are generally too low to significantly alter the thermal struc- tures of subduction zones. It has become increasingly clear in many other ways, however, that the consequences of the presence and flow of fluids is profound. Where flow is sufficiently focused and fluxes of carbon and sulfur species are high, benthic biological communities are supported on energy derived chemosynthetically. In nonaccretionary subducting mar- gins e. Water bound in hydrous minerals in the sediment and altered oceanic basement is carried to even greater depths and is driven off by increasing temperatures and pressures. Decarbonation also occurs at greater depths. The relative importance of these various sources of fluids is beginning to be understood, but the quantities involved and the impact on ocean and mantle chemistries and microbiology are poorly constrained. Early in the evolutionary stages of coarse-grained accretionary prisms, diffuse flow may be an important means of fluid expulsion Kastner et al. In fine-grained, highly consolidated, or well-cemented sediments having low permeabilities, disequilibrium between production and drain- age hence overpressure or super-hydrostatic fluid pressures evolve, causing fracture and fault zones to carry most of the flow Carson et al. Several chemical and isotopic tracers for tracking fluid flow, such as methane, chlorinity, and helium isotopes, are established. Fluids originating from compaction of sediments transported into the sub- duction system and from dehydration processes of the sediments and the subducting slab are expelled by tectonic consolidation and burial. Extreme pressures can create zero effective pressure grain to grain contact condi- tions and effectively fluidize sediments and rock, probably manifest in the formation of mud volcanoes. High fluid pressure may also reduce the effective strength of faults and earthquakes that cause fracturing, facilitat- ing focused fluid flow. Some of the bacteria may become im- portant for biomaterials. Only a small fraction of plate bound- aries have been explored, and exciting new findings resulted each time a new segment was investigated. Although many similarities exist in the Atlantic and Pacific Ocean hydrothermal vent systems and associated benthic communities, they are rather distinct in some aspects. The same is true for margins. For example, the existence of serpentine and mud volca- noes and cold seeps was a surprising discovery. Their spatial distribution and geochemical significance are as yet unknown. The following are but a few of the very intriguing and high-priority scientific questions dealing with convergent margins that can be ad- dressed through deep submergence science MARGINS, , a,b: What is the role of organic carbon in the oceanic carbon cycle margins account for more than 80 percent of the organic carbon in the ocean? Passive Margin Processes Several important processes can be addressed using submersibles on passive margins. These include determining the mass flux of meteoric water versus seawater recycling in the ocean; the consequences of various flow regimes for ocean chemistry, benthic biology, and slope stability; the sedimentological and tectonic controls on hydrology; the influence of hy- drology on accumulation and migration of hydrocarbons and gas hy- drates; and the magnitude and spatial distribution of the driving forces on fluid flow. Although fluxes, including those from meteoric sys- tems on land, are predicted to be large as revealed by Ra enrichment Moore and Vrolijk, , understanding of fluid flow regimes remains highly incomplete. Fluid flow in passive margins influences the migra- tion and accumulation of hydrocarbons, and, thus, gas hydrate forma- tion and accumulation, slope stability, and the morphology of the margins. Driving forces are derived from thermal pressure and salinity-density contrasts, as well as from topographic heads, but little is known about the magnitudes of the forces or the differences from location to location or with time. Rates of flow are only beginning to be quantified, in a few instances through the use of tracers from meteoric water e. The lateral and depth extent of passive margin fluid flow systems is not well understood. Major advances in understanding these processes, and the environmental consequences will depend on accessibility to existing and new platforms for deep submergence sci- ence. Direct measurements of flow rates through sediments, at focused and nonfocused flow sites using flowmeters deployed by submersibles, for example , can provide essential information on several of the pro- cesses mentioned above. Sampling bottom waters in areas of compli- cated bathymetry represents a technical challenge for conventional wire- line water sampling equipment.

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8: Team Benthos - Dr. Robert Whitlatch

By Ivar. Babb, Michael. De Luca, National Undersea Research Program (U.S.), United States. National Oceanic and Atmospheric Administration. Office of Undersea Research. and Undersea Science Symposium National Undersea Research Center)

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