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ATOC/Pioneer Seamount cable after 8 years on the seafloor: Observations, environmental impact

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Abstract

A study was conducted on the impacts of the presence of the Acoustic Thermometry of Ocean Climate (ATOC)/Pioneer Seamount cable on the benthos from nearshore waters adjacent to its origin at Pillar Point Air Force Station in Half Moon Bay, California to its terminus 95 km along its length on Pioneer Seamount. The coaxial Type SD cable was installed, unburied on the seafloor in 1995. Thirteen sites along the cable route were surveyed using the Monterey Bay Aquarium Research Institute (MBARI) ROVs *Ventana* and *Tiburon* equipped with cable-tracking tools. Quantitative comparisons of biological communities and seafloor features between cable and control sites were performed at nine stations. Forty-two hours of video footage and 138 push cores were collected over 15.1 km of seafloor. Approximately 12.1 km of the cable was observed (13% of the cable route).

This study documents the appearance and condition of the cable and the underlying seafloor, and the effects of the cable on biological communities along its route. Limited self-burial of the cable has occurred during the 8-year deployment, particularly over the continental shelf and upper slope. Cable strumming by nearshore wave action has incised rocky siltstone outcrops. Several observations of kinks and snags in the cable on the upper slope (~240 m depth) suggest contact with trawling gear.

Few changes in the abundance or distribution of benthic fauna were detectable from video observations (epifaunal) and sediment core samples (infauna). Of 17 megafaunal groups and 19 infaunal taxa, no tests evaluating the overall effect of the cable were statistically significant. While these results indicate that the biological impacts of the cable are minor at most, three megafaunal groups exhibited cable-related changes at one or more stations. Actiniarians (sea anemones) colonized the cable when it was exposed on the seafloor, and were therefore generally more abundant on the cable than in surrounding, sediment-dominated seafloor habitats. Some fishes were also more abundant near the cable, apparently due to the higher habitat complexity provided by the cable. The study also documents general changes in the benthos across the Central California continental margin.

Keywords: Submarine cables; Benthic biota; Environmental impact; ATOC; Continental margin; Sediments

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1. Introduction

Over the last century, millions of kilometers of seafloor submarine cables have been installed for telecommunications purposes. These cables are typically 2–8 cm in diameter and are able to transmit power and data over long distances. The telecommunications industry has built an extensive undersea network that interconnects the large urban centers of the world (Williams, 2000).

Interest in using subsea cables for scientific purposes is increasing. Scientists want to utilize the power and data transmission capability of underwater cables to develop seafloor observatories (Chave et al., 2004). A variety of coastal and marine scientific cabled observatories such as Leo-15 and H2O Hawaii have already been installed (e.g. Kasahara et al., 2000; Petitt et al., 2002; Schofield et al., 2002) and others such as NEPTUNE (http://www.neptune.washington.edu/), VENUS (http://www.venus.uvic.ca/), and MARS (http://www.mbari.org/mars/) are in varying stages of development. Whereas the traditional mode of marine data collection consists of shipboard surveys, seafloor cables allow continuous data collection and transmission from instruments and experiments. High-frequency observations promise to improve our understanding of the ocean and could lead to major new discoveries regarding marine systems. Electric power supplied by cables also makes new generations of seafloor instrument systems possible.

Submarine cable installation, maintenance, presence on the seabed, and removal affect the environment (Zajac, 1957; Horne, 2002). While burial assessment (BAS) and post-lay inspection and burial (PLIB) surveys are frequently conducted with the focus of documenting substrate type and cable burial, the information generated by these surveys is usually available only in obscure gray literature reports or in regulatory agency files. Few published studies exist on the interaction between cables and the marine environment (Andrulewicz et al., 2003; Heezen, 1957; Marra, 1989; Reiter and Deis, 2000; Sultzman et al., 2002).

Concern regarding impacts to the environment persist, thus there is a need to improve our understanding of the actual environmental impacts of submarine cables. This paper provides a case history of the effect of the coaxial Type SD Acoustic Thermometry of Ocean Climate (ATOC)/Pioneer Seamount cable on the benthic environment.

2. ATOC/Pioneer Seamount cable history

The ATOC/Pioneer Seamount submarine cable extends approximately 95 km between Pioneer Seamount and the Pillar Point Air Force Station in Half Moon Bay, California (Howe, 1996; Mercer, 1999; Fig. 1). The cable was installed for scientific

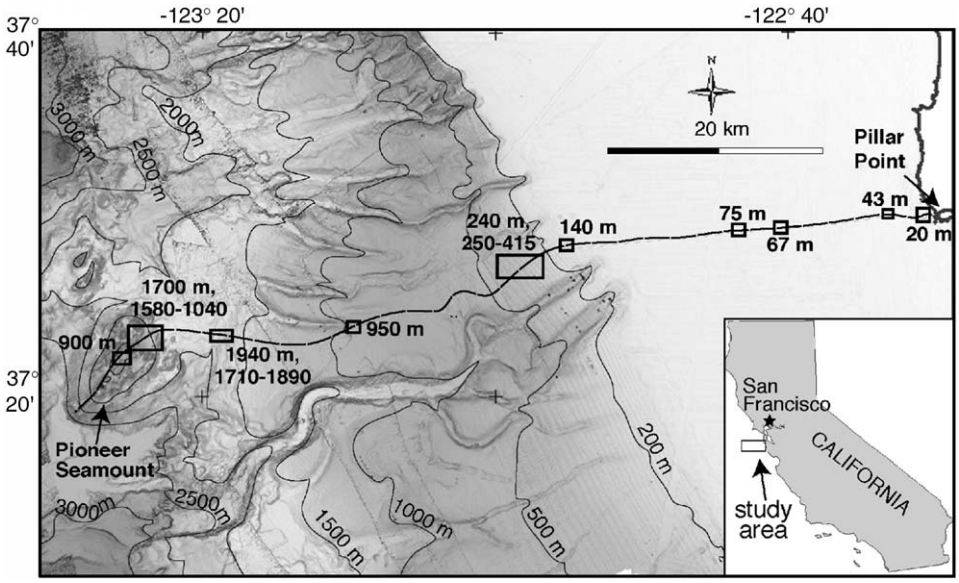

Fig. 1. Shaded relief map showing the location of the ATOC/Pioneer Seamount cable (dashed line) and the 13 survey locations (boxes). Basemap is courtesy of David Caress (MBARI).