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Structural Filter

Dong Liu

Structural Filter (SF) is a smoothing filter used in pre-stack noise reduction that preserves edge while removing noise. Structural Filter can handle abnormal single high amplitude event, outliers, and strong random noise in pre-stack domain. By preserving edge effect, the filter can also preserve lateral amplitude variation with offset (AVO) in most horizontal and dipping events presented in seismic gathers. Structural Filter as a robust pre-stack noise suppression technique play a very important role in AVO analysis because CDP stacking, the most powerful noise suppression tool in seismic processing is not available in pre-stack seismic data processing.

Focused on Evaluate and analyze Structural Filter in real seismic data, during this study Structural Filter (SF) was applied to Common Midpoint (CMP) and Common Reflection (CRP) Gathers in eight 2D seismic lines from Llanos Basin, Colombia. Both stacked section after filtered CMP and CRP gathers observe enhancement of seismic reflector's continuity which confirm the edge preserving property on Structural Filter. In CMP gathers SF shows enhancement in Amplitude variation with Offset (AVO) while removing random noise. During the filtering process the data's Signal to Noise ratio can be significantly diminished if the filter parameter is chosen very strong, However this problem can be overcome by combining SF with pre-stack F-XY decon. Because the presence of dipping layers that disagree with the basic assumption of CMP gathers, Structural Filter was applied to CRP gathers. the result show that the filter preserved true amplitude while suppressed noise and improved Signal to Noise (S/N) ratio. The application of Structural Filter has produced higher quality Angle Gathers, and therefore contributed to the possibility to get more accurate results when performing AVO analysis. ■

Age Estimates of Holocene Glacial Retreat in Lapeyrère Bay, an Anvers Island Fjord

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The Antarctic Peninsula is one of the fastest warming regions on earth, yet the region's Holocene paleoclimate is poorly constrained. Lapeyrère Bay is a fjord on the eastern side of Anvers Island, located off the Western Antarctic Peninsula. Anvers island has a maximum elevation of 2400m, and experiences colder temperatures and more precipitation than the South Shetlands which are ~230km to the north. Two glaciers enter Lapeyrère bay, one large and vulnerable to avalanching, the Iliad Glacier, and one smaller glacier confined to a northern unnamed cove. Though a large amount of data has been gathered by cruises in Lapeyrère Bay, very little has been published on the fjord's glacial retreat history or sediment flux. The primary purpose of this study is to reconstruct the glacial retreat and sediment flux histories of Lapeyrère Bay using cores for chronology and facies analysis, and multibeam swath bathymetry data for identifying seafloor morphological features.

Preliminary core data from the proximal northern flank of Lapeyrère Bay shows a greenish grey sandy mud with scattered pebble and sand lens lithology. A kasten core and a jumbo piston core taken coincidently in the distal-most part of the fjord are largely diatomaceous sediment grading into grey silty mud with thin sandy turbidites. Multibeam data has exposed seafloor features including a grounding zone wedge at the entrance of the unnamed cove of northern Lapeyrère bay, drumlins, glacial lineations, and a glacial outwash fan near the ocean-termination of the Iliad glacier.

Additionally, this study seeks to assess the effectiveness of a novel radiocarbon (14C) chronological method of dating Antarctic Peninsula cores lacking sufficient calcareous material for carbonate 14C dating. The method being tested is ramped pyrolysis, which dates individual fractions of organic material. It is hypothesized that ramped pyrolysis will improve upon bulk Acid Insoluble Organic Material (AIOM) dating, as AIOM consistently dates samples as erroneously old. Performing ramped pyrolysis 14C dating and carbonate 14C dating on the same cores and comparing the resulting ages will address this hypothesis.

Carbonate radiocarbon dating has been completed for cores taken in the proximal fjord. Four dates from a 20.3m drill core yield an average sedimentation rate of 2.2mm/yr. Four dates from the nearby 293cm gravity core yield a sedimentation rate of 1.4mm/yr. Ramped pyrolysis has been performed on a total of nine samples, six taken from

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the proximal drill core and three taken from the distal-most gravity core of the fjord. In order to know the amount of sample necessary for pyrolysis TOC percentages were found for each sample. The average proximal sample TOC is 0.22%, and the average distal sample TOC is 0.55%. These values show a trend of increasing TOC values with increasing oceanic influence in the distal fjord. Pyrolyzed samples were dated at the Woods Hole Oceaceanographic Institution, and results are discordant with previous ramped pyrolysis studies. Dates from each sample are less dispersed than expected, though two show clear temperature plateaus indicating the true age of the sample. These true ages are neither consistently older nor younger than the carbonate 14C dates taken from foraminifera in the same samples. ■

Comparison Of Glacial Geomorphic Features In Antarctic Peninsula Fjords Based On Multibeam Swath Bathymetry Data

Y. Muñoz, J.S. Wellner, K.A. Mead, and L.A. Hardin

A distinctive suite of subglacial geomorphic features, representing the grounding of an ice sheet and its subsequent retreat, has been well-documented as occurring on many parts of the Antarctic continental shelf. Elements that characterize this suite include meltwater channels, drumlins, mega-scale glacial lineations, and gullies. Many of these same elements occur in more recently deglaciated fjords, but at different scales and in different combinations. Bathymetric soundings have been collected during transit onboard the RV/IB Nathaniel B. Palmer in various expeditions to the Antarctic Peninsula. Multibeam swath bathymetry data were acquired using a Simrad EM120 hull-mounted swath profiler consisting of 120 beams of 12 kHz data. The data were edited for anomalous readings by the scientific party of each cruise while onboard; later the data were gridded and processed to create relief maps. The vertical and horizontal resolution of the data is 10 meters. The study includes ten fjords on the north and west side of the Antarctic Peninsula, from the Graham Land Coast around to Hope Bay as well as on Anvers Island. The multibeam data has been reprocessed using different software packages including MB Systems, ArcGIS, Fledermaus, and CARIS resulting in high-resolution images. The different methods used to plot the bathymetric data complement each other as the capabilities of each method vary. Diverse measurements, including dimensions of the different morphological features, and calculations like slope, ice drainage area, and sediment volumes were made using these acoustic techniques. Comparison of the geomorphic features from the ten fjords show certain trends. Meltwater channels are much more prevalent within the fjords than on the open shelf. Mega-scale glacial lineations within the fjords have much shorter average lengths than those on the open shelf; this is attributed to the irregular seafloor topography that characterizes the fjord floor. Finally, some fjords are characterized by a series of back-stepping grounding zone wedges, which mark times during which ice was stabilized during retreat. The locations of these pauses in retreat correlate to narrow and/or shallow parts of the fjord and demonstrate the control of pre-existing bathymetry on ice retreat. The multibeam data provide a better understanding of the geomorphic features in each fjord and thus a clearer interpretation of the retreat history in each of them. ■

Subsurface Imaging with VSP and Ocean Bottom Seismometers (OBS): Novel Acquisition Designs

Emin E. Pacal and Robert R. Stewart

Recording of ocean-bottom seismometer (OBS) data has several advantages over conventional near-surface recording. Because of their deployment on the sea floor, OBS are less vulnerable to noise and disturbances in the water column and thus have a relatively higher signal-to-noise ratio. OBS also offers wide-azimuth (WAZ) and full-azimuth (FAZ) geometries, which are important for imaging the complex structures such as salt domes. Vertical seismic profile (VSP) reflection surveys help to define a salt-sediment interface near a wellbore by using offset sources. VSP with circular shooting has been using for 3D imaging near the borehole. VSP itself, however, still has some limitations such as poor offset and angular coverage per bin and limited total bin fold. This imaging limitation in the VSP can be lessened by combining ocean-bottom seismometers on the sea floor with the VSP borehole survey. We show a number of model examples using combined borehole and ocean-bottom recordings to improve azimuth, offset and fold distribution. Survey designs were created in OMNI 3D to compare and examine.

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