Drainage area of selected glacial systems Graham Land, Antarctic Peninsula. (Refer to figures 1 and 2 for location of individual systems.)

Fjord or bay system	Glacial system	Drainage area (square kilometers)
Lanchester Bay	Temple Glacier	521.163
	Wright Ice Piedmont	748.800
Cierva Cove	Gregory & Breguet	381.770
Brialmont Cove	Cayley Glacier	820.327
Lapeyrere Bay	Illion Glacier	193.656
Borgen Bay	Williams Glacier	126.241
	unnamed glacier	33.059
Andvord Bay	Moser, Rudolph	173.94
Lester Cove	Grubb & Bagshawe	271.604
Flandres Bay		
Etienne Fjord	unnamed glacier	351.822
Penola Strait		
Deloncle & Girard Bay	Hotine Glacier	145.363
	Leay Glacier	23.012
Edge Hill	Wiggins Glacier	107.767

Williams and J.G. Ferrigno of the U.S. Geological Survey (Reston, Virginia) for their assistance in obtaining Landsat imagery of the Peninsula region.

References

Domack, E.W. 1988. Depositional environments of the antarctic continental shelf: Fjord studies from the R.V *Polar Duke*. *Antarctic Journal of the U.S.*, 23(5), 96–102.

Domack, E.W., L.A. Burkley, and C.R. Williams. 1989. Character of modern glacial marine sediments: Antarctic Peninsula and South Shetland Islands. *Antarctic Journal of the U.S.*, 24(5).

Domack, E.W., and C.R. Williams. In press. *Fine structure and suspended sediment transport in three Antarctic fjords.* (Antarctic Research Series, First Annual Volume.) Washington, D.C.: American Geophysical Union.

North Bransfield Basin: R/V *Polar Duke* cruise PD VI-88

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During May, 1988, R/V *Polar Duke* collected a total of 2,480 nautical miles of digitally recorded single-channel seismic data in the vicinity of the northern Antarctic Peninsula. In addition, 17 cores were taken, primarily for thermal conductivity measurements. We had planned to investigate both the Powell Basin (figure 1) immediately to the east of the tip of the peninsula, and the King George Basin of Bransfield Strait. Unfortunately, multi-year ice coverage of both locations precluded our working in the Powell Basin at all and allowed only coring and a very limited seismic survey in the King George Basin. Instead of our planned work, we took the opportunity to investigate the North Bransfield Basin and to complete a survey of the Hero Fracture Zone that had been begun on a cruise aboard R/V *Polar Duke* in April 1987.

Extension between the Antarctic and Drake plates ceased at anomaly 3 time (4.5 million years ago). Prior to 4.5 million years ago, the North Bransfield Basin was the site of a fairly complicated triple or quadruple junction involving the Antarctic, Scotia, Drake and possibly South Shetland plates. If back-arc spreading had occurred in Bransfield Strait, then there would have been a South Shetland plate between the South Shetland Trench and the spreading axis in Bransfield Strait. If, on the other hand, Bransfield Strait is only 1.3 million years old as some investigators propose (Barker 1982), then the Scotia, Antarctic, and Drake plates would have met at a fairly standard triple junction prior to 4.5 million years. If subduction stopped or slowed dramatically as it would be expected to when the Drake-Antarctic Ridge ceased spreading 4.5 million years ago, it is difficult to explain the Bransfield Strait as a standard back-arc basin, since seafloor spreading would have started 3 million years after subduction had presumably stopped.

The North Bransfield Basin has an axial deep that appears linear to the southwest but becomes confused as it nears the southwest face of Clarence Island. There is also a lineated magnetic high but does not coincide with the axial deep. The axial deep seems to step northward until it terminates abruptly at the very steep southwestern face of Clarence Island (61°15'S 54°W). We investigated the North Bransfield Basin by running

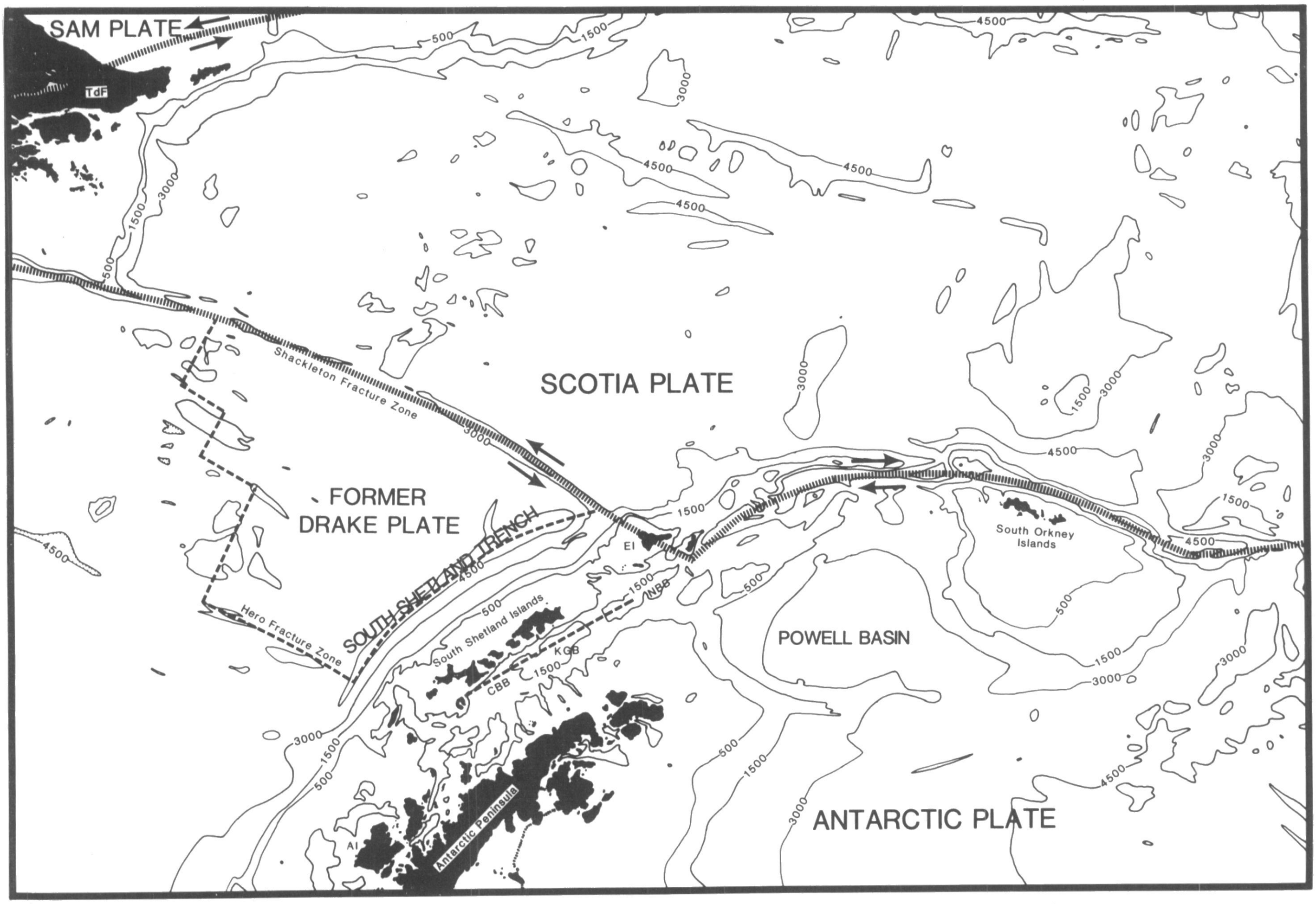

Figure 1. Generalized bathymetric map of the Antarctic Peninsula and western Scotia Sea region [taken from British Antarctic Survey Sheet (Mis.) 3 1985]. Contours are in meters. (AI denotes Anvers Island, CBB denotes Central Bransfield Basin, EI denotes Elephant Island, KGB denotes King George Basin, and NBB denotes North Bransfield Basin.) Active plate boundaries indicated by heavy dashed line. Former Drake Plate boundaries indicated by lighter weight dashed line. Line of active volcanism in Bransfield Strait indicated by single dashed line. Arrows indicate directions of plate motions along active plate boundaries.

10 single-channel digitally recorded seismic lines orthogonal to the trend of the basin (figure 2). We noticed the dramatic change in dip of the beds as we crossed the minor V-shaped depression on line G-H at 0220 (figure 3). The seismic lines have been arranged so that the axial deep is aligned on each of them and corresponds to the line on the location figure (figure 2). On line P-O, the V-shaped dip apparent on G-H is hardly noticeable, but tilted beds can be detected to the northwest. A different V-shaped dip can be observed about 5 kilometers to the northwest, which again contrasts prominent tilted beds to the northwest of the dip with less prominently tilted beds across the V-shaped dip. We think that the tilted beds are produced by normal faults caused by a general extensional regime in the North Bransfield Basin. The same two sets of tilted blocks seen on G-H and P-O are apparent on M-N. To the northwest of the axial deep as many as three and possibly four southeasterly tilted blocks can be seen on J-I. Since the blocks all seem to be faulted in the same manner whether they are to the northwest or southeast of the axial deep, a cross-section of the North Bransfield Basin is reminescent of Wernicke's model for continental crustal extension. It is not similar to the accepted model for slow seafloor spreading that would have outwardly dipping blocks symmetrical about the axial valley. In the case of the North Bransfield Basin, the axial deep may not be a locus of seafloor spreading but may simply be the normal fault with the greatest amount of throw on it. The bathymetric map (figure 2) of the North Bransfield Basin shows that some of the normal faults are quite linear and can be traced for 20 to 30 kilometers while the tilted blocks may be only 5 to 8 kilometers wide.

Clarence Island is bounded on the southeast by a linear deep known as the South Scotia Ridge which marks the active plate boundary between the Antarctic and Scotia plates. The Shackleton Fracture Zone to the northwest is also an active plate boundary between the Antarctic and Scotia plates and crosses Elephant Island. When the Drake Plate ceased to exist, the Antarctic-Scotia Plate boundary had to adjust to an approximate 110° bend near the southern point of Clarence Island. Both the eastern half of Elephant Island and Clarence Island are composed of blue-schists, indicating a high-pressure, low-temperature environment (Dalziel 1984). We propose that Elephant and Clarence islands being on the inside of the bend in the plate boundary are being squeezed up while the North Bransfield Basin is undergoing extension because it is on the outside of the bend in the plate boundary.

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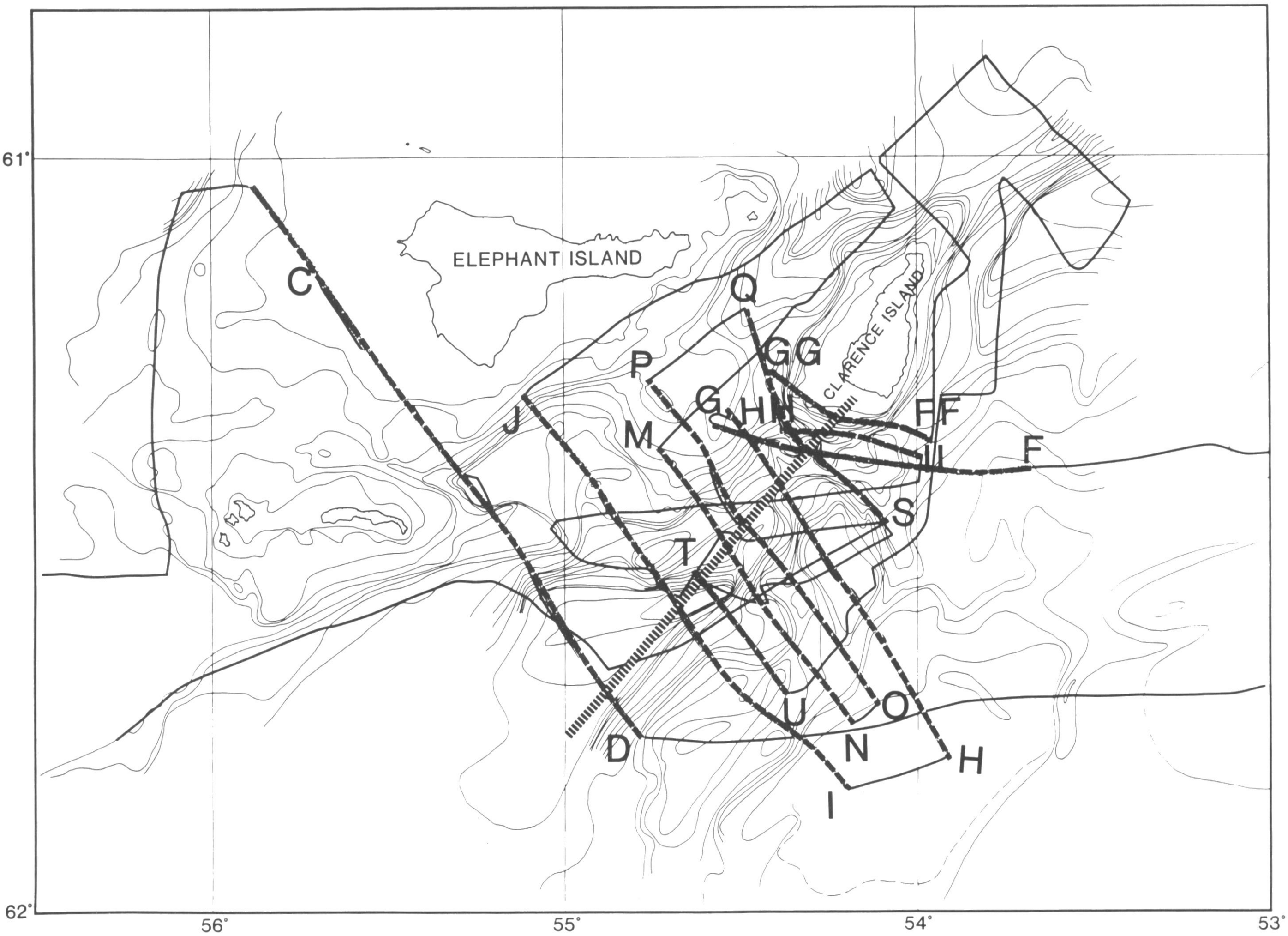

Figure 2. Detailed bathymetric map of North Bransfield Basin. Contour interval is 100 meters. Locations of single-channel seismic lines shown in figure 3 are indicated by dashed line. Axis of North Bransfield Basin used to align seismic profiles shown in figure 3 indicated by a heavy dashed line.

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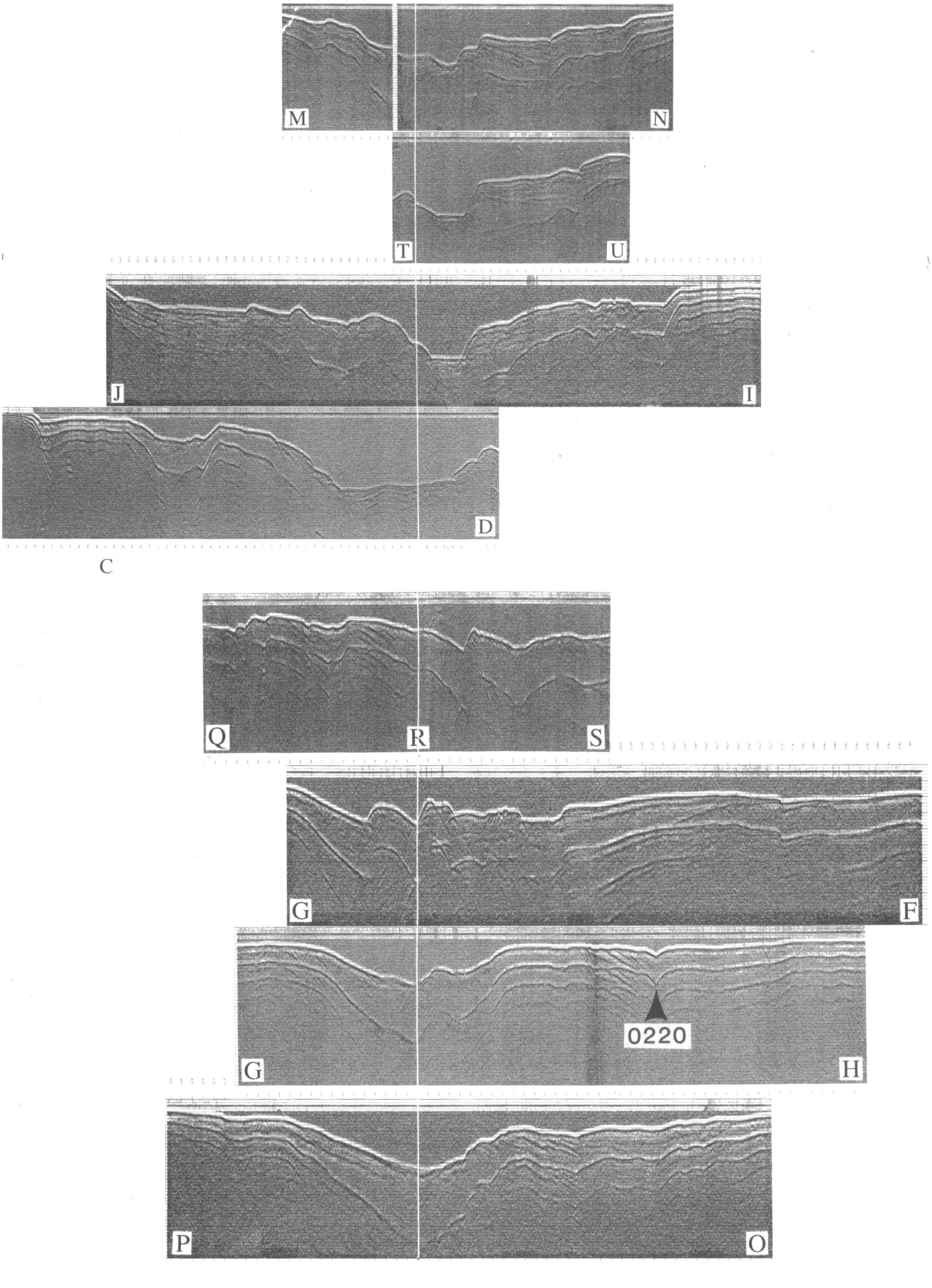
References

Barker, P.F. 1982. The Cenozoic subduction history of the Pacific margin of the Antarctic Peninsula: Ridge crest-trench interactions. *Journal of the Geological Society of London*, 139, 787–802.

British Antarctic Survey. 1985. *Tectonic map of the Scotia Arc. 1:3,000,000.* [BAS Sheet (Misc.)3]. Cambridge: British Antarctic Survey.

Dalziel, I.W.D. 1984. *Tectonic evolution of a forearc terrane, southern Scotia Ridge, Antarctica.* (Geological Society of America, Special Paper 200.) Boulder, Colorado: Geological Society of America.

Figure 3. Digitally recorded single-channel seismic lines are shown with northwest to the left. Arrow indicates 0220 on line G-H. A prominent multiple is seen on all of the seismic lines.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