Report on M61/2: Crustal structure of the Porcupine Basin, west of Ireland

The Porcupine Basin west of Ireland represents an ideal opportunity to study the effect of progressie extension from the development of a rift to the formation of a pair of conjugate continental margins. In the north, the maximum stretching factors in the basin (the factor by which the crust has been extended and thinned) are as low as 1.5, but increase to the south to values in excess of 6, which are typical for regions where complete continental breakup has occurred to form an ocean. Thus a series of east-west profiles across the basin reveal the structure of the basin at different amounts of extension. These can be used as a proxy for the evolution of a riftedmargin from early rifting to final breakup. Furthermore, as both sides of the rift canbe studied along a single profile in the Porcupine Basin, the symmetry of the process can be studied throughout its evolution.

M61/2 set out to study the structure of the Porcupine Basin west of Ireland using wide-angle seismic methods to determine crustal structure and thus help constrain the amount and style of extension leading to the formation of the basin. The scientific party consisted of a group of 17 scientists and students from Germany (including two meteorologists) and four scientists from partner institutions in Ireland (see Table 1). We left Cork on the evening of the 8th May and reached our working area the next day.

1. Prof. Dr. Tim Reston	Chief Scientist	IfM-GEOMAR
2. Gerald Klein	Processing + Archive	IfM-GEOMAR
3. Noemi Fekete	Processing + Archive	CAU
4. Peter Thierer	OBH/S	IfM-GEOMAR
5. Petra Liersch	OBH/S	IfG, Hamburg
6. Holger Neiss	OBH/S	IfM-GEOMAR
7. Alexandra Ivanova	OBH/S	IfM-GEOMAR
8. Marc Baxmann	OBH/S	IfM-GEOMAR
9. Jörg Hasenclever	OBH/S	CAU
10. Sonja Kriwanek	Parasound + Hydrosweep	CAU
11. Gerlind Wagner	watches	CAU
12. Wiebke Brunn	watches	CAU
13. Rolf Ingenfeld	watches	IfM-GEOMAR
14. Ute Thurow	watches	CAU
15. Klaus-Peter Steffen	Technician (Airguns)	KUM
16. Herr Kahl	Meteorology	DWD
17. Herr Ochsenhirt	Meteorology	DWD
18. Dr. Steve Jones	Guest	TCD Ireland
19. Eloise Rogers	Guest	TCD Ireland
20. Anne Chabert	Guest	DIAS, Ireland
21. Dr. Laurent Gernigon	Guest	DIAS, Ireland

IFM-GEOMAR:	Leibniz-Institute for Marine Sciences, Kiel
CAU:	Students at Christian-Albrechts-University, Kiel
IfG, Hamburg:	Student at the Institute for Geosciences, University of Hamburg
KUM	Kiel Umwelttechnologie (instrument technician)
DWD:	Deutsche Wetterdienst (meteorologists)
TCD:	Trinity College Dublin
DIAS	Dublin Institute of Advanced Studies.

Table 1: list of participating scientists and their institutions.

The wide-angle profiles were collected using up to 25 ocean bottom instruments (all equipped with hydrophones and 15 of which were also equipped with three component geophone packages) to record the seismic energy generated by two or three 32 litre airguns towed behind the ship. The airguns were fired every 60 seconds. Landstations manned by colleagues from the Dublin Institute of Advanced Studies (DIAS) also recorded the shots, providing crucial data in the near shore areas where it was impossible for the ship to work. Finally, a gravimeter installed in Cork provided the complementary measurements of variation in the earth's gravity field due to the underlying basin structure.

A total of 5 wide-angle profiles were collected along existing high quality industry data from Fugro-Geoteam - profiles SPB97-106, -115, -138 and -206 as well as along profile WIRE 2 from the BIRPS group (see Table 2 and Figure 1).

Profile	Reflection line	ocean bottom instruments	Start shooting	End shooting
1	115	25 stations between *51°28N, 11°21W and 51°25, 13°56´*W	51°24,8 N, 15° W	51°29,3 N, 10°35´W
2	106	24 stations between 51°43N, *13*°58´W and 51°43N, 11°25 W	51°43 N 10°50 W	51°43´N, 15° W
3	WIRE 2	23 stations between 52°15N, 11°40W and 52°15N,10°45W	**52°15´N, 15°W**	**52°15´N, 10°30 W**
4	206	17 stations between 52°20N, 12°45 W and 51°09 N, 12°45 W	50°40 N, 12°45 W	52°50 N, 12°45 W
5	115 (reshoot)	7 stations between 51°26 N, 12°57 W and 51°27 N, 12°21 W	51°28´ N, 11°40´ W	51°26,5N, 12°57 W
6	138	12 stations between 51°17.4 N , 11°22 W and 51°08 N, 12°50 W	51°18 N, 11°12 W	51°08 N, 12°50 W

Table 1: Summary of wide-angle seismic data collected during the cruise.

The first profile to be collected was along line 115. Deployment of a total of 25 instruments started on May 9th; the final instrument was deployed early on the 10th of May. We reached the start of the line at 07:30 local time at co-ordinates 51°25´N, 14°51´W, and deployed all three 32 litre airguns. We finished shooting the line at 01:30 on the 12th May and started operations to recover the instruments. Recovery proceeded smoothly and was completed at 03:00 on the 13th. However analysis of the ocean bottom instruments records showed that water-borne noise from a commercial seismic vessel (the RAMFORM VALIANT) posed a severe problem at offsets even over 100 km. As a result as we deployed instruments along our second profile at a latitude of 51°45´N, we negotiated a time-sharing agreement with the RAMFORM VALIANT for the rest of the month, in which they would be free to operate while we were deploying or recovering instruments, and when we were ready to shoot we would shoot for 12 hours and then pause for 9 hours allowing the seismic vessel to collect two shorter profiles. If the weather conditions did not allow one ship to shoot, the other of course would be able to shoot through if possible. On the basis of this agreement we started shooting Profile 2 (along the line 106) at 11:00 local time on the 14th May within site of the west coast of Ireland, and completed the profile at 07:40 on the 16th May.

Profile 3 was another east-west profile located further north along the track of the BIRPS deep seismic profile WIRE (West of IREland) 2. As one of the instruments malfuntioned on Profile 2, we only deployed 24 along profile 3. We started to shoot the line on the morning of the 18th May - shooting finished on the night of the 19th-20th, the halfway point of the cruise.

Profile 4 was a north south line passing through the middle of the other lines at a longitude of 12 45. The middle portion of the line followed the reflection profile 206, but the wide-angle line extended considerably further north and south than the reflection line. For this reason, where possible we also deployed a ministreamer while shooting this profile to image the seafloor and hopefully the top of basement. At the same time as shooting line 4, we also reshot part of line 1 where the noise from the commercial vessel's shooting had proved most disruptive. As a result, we deployed 18 instruments on line 4 and a further 6 instruments on the reshot portion of line 1 (line 5). One instrument failed to release acoustically on the line, although it subsequently came up on time release (see below).

The final line shot (6) was another line approximately east-west, following reflection profile 138. This profile was shot with 12 instruments, and completed just as a large swell from a storm further north-west started to arrive. However all instruments were safely recovered, including the instrument missing from line 4 which released on time at the cruise end. We returned to Cork on the 30th May just a few hours ahead of schedule.

All in all, the cruise M61/2 was highly successful, with excellent data, good weather and most importantly generous support from our colleagues in Ireland.

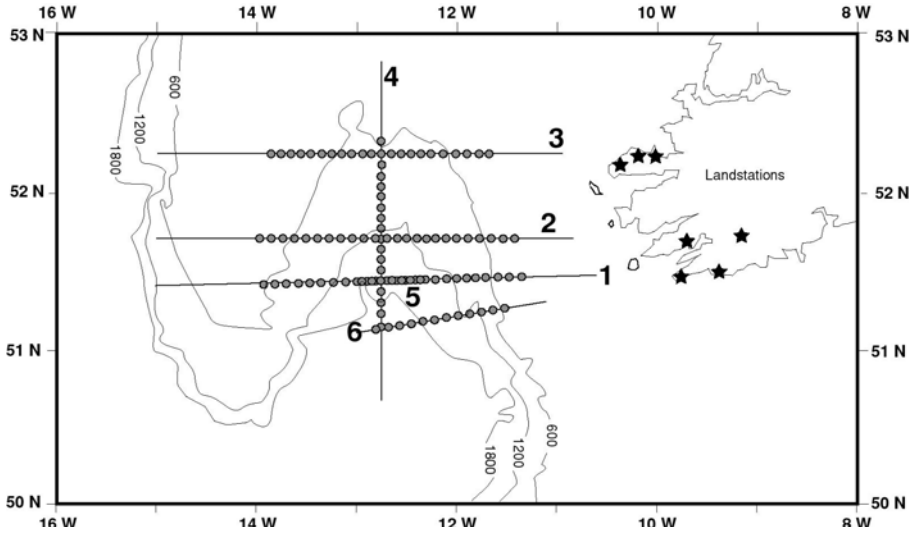

Figure 1: Map of study area showing shooting profiles (straight lines), ocean bottom seismometer / hydrophone stations (circles) and landstations manned by Irish colleagues (stars). Thin lines are bathymetric contours (600 m interval).