

The Tertiary orogenic belt of West Spitsbergen: Seismic expressions of the offshore sedimentary basins. A comment

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Eiken & Austegard (1987) have presented a number of seismic sections offshore, west of Spitsbergen, which highlight a series of graben structures infilled with sediments interpreted to be of Tertiary age. This age is contested, based on grab-sample data and correlation with adjacent basins onshore, along the west coast of Spitsbergen. It is suggested that these offshore basins may be infilled with sediments of late Paleozoic and Mesozoic age.

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Eiken & Austegard (1987) presented a series of offshore seismic reflection profiles west of Spitsbergen. Such data can only increase our understanding of the area as it expands upon field observations and mapping onshore Spitsbergen. In addition, an insight is given into subsurface basin geometries which can only be assumed from onshore field studies.

Eiken & Austegard (1987) mapped a series of graben structures offshore west of Spitsbergen, particularly south of Isfjorden. The largest of these basins lies to the west of Nordenskiöld Land and is referred to by the authors as the Isfjordenrenna–Bellsund Graben. This basin is offset from two grabens west of Hornsund and the Forlandsundet Graben, which lies north of Isfjorden. These offsets were tentatively interpreted as E–W trending transfer faults by Eiken & Austegard (1987), who were unable to relate such structures to onshore faults.

The sediments which infill the grabens offshore west of Spitsbergen are interpreted to be of Tertiary age (Eiken & Austegard 1987), similar to those in the Forlandsundet Graben. Eiken & Austegard (1987) acknowledged that older sediments may be present, but due to the absence of a major unconformity, these strata were thought

to lie within the ‘basement’ at depth. The evidence presented for this interpretation is based on seismic velocities and the inferred southward continuation of the Forlandsundet Graben. The Tertiary age of the sediments offshore west of Spitsbergen is contested and consequently discussion on the age of the grabens and the role of strike-slip tectonics should be reconsidered. It is suggested that an early Carboniferous age is more likely, although late Carboniferous, Permian and Triassic aged sediments may also be present.

There are several lines of evidence to support an early Carboniferous to Triassic age for the sediments infilling the grabens offshore west of Spitsbergen. Firstly, grab-sample results from the west Spitsbergen region (Dibner 1978) suggest that subcropping strata are of Triassic, Permian, Carboniferous and Early Paleozoic age. No Tertiary samples were recorded. Although grab sampling is not an accurate method of mapping, it does indicate the age of strata present in the subsurface within a region. If Tertiary rocks are present then samples of this age should have been recorded in the results. Secondly, the age of sediments outcropping onshore is also inconsistent with a Tertiary model. The seismic section UB 38–81 lies to the west of a basin, the West

Sørkapp Land Basin (Mann & Townsend in press), which crops out south of Hornsund and is infilled with early Carboniferous Billefjorden Group and Triassic Sassendalen Group sediments. The West Sørkapp Land Basin extends offshore to the west and is bound to the east by a series of extensional faults against the Hornsund–Sørkapp High. These faults are believed to have controlled sedimentation in early Carboniferous and Triassic time. The eastern end of seismic section UB 38–81 crosses the western margin of a graben structure which we interpret to represent the offshore portion of the West Sørkapp Land Basin. Further north, the correlation of the Isfjordrenna–Bellsund Graben with the Forlandsundet Graben is considered more likely. Nevertheless, half-graben structures containing early Carboniferous Billefjorden Group sediments are exposed onshore in north Bellsund (see for example Hjelle et al. 1986) and therefore we suggest that a correlation of certain lower horizons in the Isfjordrenna–Bellsund Graben with the Billefjorden Group is also plausible. In particular, a small graben structure at the mouth of Isfjorden is illustrated on line UB 22–81. In addition, syndepositional structures (sediment thickening towards active faults and internal unconformities) recognized in the offshore grabens are similar to those observed in early Carboniferous rocks onshore in Bellsund and further east in the Billefjorden Trough (Gjelberg & Steel 1981).

One further point to be made about the paper is that transfer faults which link (or offset) fault systems, or in this case, grabens, do not necessarily continue beyond the structures they are connecting (see, for example, Bally 1981 and Etheridge 1986). Although E–W trending transfer faults are the likeliest explanation for the offset of the grabens offshore west of Spitsbergen, such faults should not necessarily be expected to cut strata exposed onshore.

Eiken & Austegard (this volume) have presented an additional seismic section west of Hornsund and an accompanying velocity section. Although the original profile is not available to us, we would like to comment on this new data.

The velocity section shows two graben structures separated by a high. The eastern structure is clearly part of the West Sørkapp Land Basin, due to the close proximity to Hornsundneset. The western graben is infilled with sediments showing a similar velocity which we interpret as early

Carboniferous sandstones. This unit is overlain by a sequence of lower velocity sediments (2.0–3.0 km/s) which may represent Triassic shales. This interpretation is supported by onshore field studies (Mann & Townsend in press) and is not incompatible with the seismic velocity measurements of Grønlie (1978).

Publication of the seismic sections off the west coast of Spitsbergen by Eiken & Austegard (1987) are welcomed as an aid to a more complete understanding of the geology of Svalbard. Hopefully more data will be released in the near future to allow further discussion. Although the results of these seismic studies are of great value in the formation of tectonic models for the region, the Tertiary age interpretation of the sediments which infill the basins should be treated with some caution. An early Carboniferous to Triassic age should also be considered until drilling programmes reveal the true age of the offshore sediments. In the meantime the presence of basins of Late Paleozoic to Early Mesozoic age in this offshore area is a plausible alternative to the Tertiary age suggested by Eiken & Austegard (1987).

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