



Crustal structure of the Podvodnikov Basin

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The Podvodnikov Basin (called the Wrangel Abyssal Plain by IBCAO or the Wrangel Perched Rise by Jakobsson et al, 2003) is a nearly flat plain, c. 3000 m below sea level, dipping $< 0.5^\circ$ northwards from the Eurasian margin of the New Siberian Islands. It is defined here as extending northwards to c. 86°N , where there is an abrupt deepening into the Makarov Basin (also called the Fletcher Basin or East Siberian Basin). The Podvodnikov Basin is readily divided into two parts, northern and southern, by the Arlis Gap (also called the Arlis Rise).

The Basin is crossed by shallow reflection profiles recorded from drifting ice-islands ("North Pole-28", "Transarctic-1989, 1991") and by the wide-angle refraction profile "Transarctic-1989-1991". In addition to this N-S profile, the refraction profiles "Transarctic-1992" (across the Lomonosov Ridge) and "Arctic-2000" (across the Mendeleev Ridge) cross the western and eastern margins of the Basin at 83°N and 82°N respectively.

The "Transarctic 1989-1991" profile (Lebedeva-Ivanova et al, 2004) reaches from the East-Siberian continental shelf northwards nearly to the North Pole. It defines the velocity structure of the continental shelf and its truncation at the shelf edge at 80.3°N . To the north along this profile, the Podvodnikov Basin is underlain by a c. 20 km thick crust. Beneath c. 2 km of unconsolidated and partially consolidated sediments ($V_p = 1.7\text{--}2.8$ km/sec), and more consolidated sediments ($V_p = 3.5\text{--}3.8$ km/sec) with a thickness of 2.0–7.0 km, there occurs a c. 4 km thick basement, with a V_p of 5.0–5.2 km/sec; this is underlain by an up to 6 km thick unit with a V_p of 6.1–6.3 km/sec. The lower crust is 6–11 km thick and has a velocity of 6.9–7.4 km/sec. Beneath the Arlis Gap, the basement surface rises to c. 5 km depth and the overlying sediments thin to c. 1 km. The "Transarctic 1989-1991" profile crosses the western end of the "Arctic-2000" profile at c. 82°N , where there is good agreement between both the two

data sets.

Between the "Arctic-2000" (Mendeleev Ridge) profile and "Transarctic-1992" (Lomonosov Ridge) profile no seismic data have been acquired and the structure of the Podvodnikov Basin has been interpreted based on potential field data. Gravity data show that beneath the flat-lying sediments of the Basin, separate from, but close to the Lomonosov Ridge, there is a prominent positive feature, that is probably a basement fault-block related to the Lomonosov Ridge. Further east beneath the Basin along this profile, the depth of the Moho is c. 18-22 km, in good agreement with the N-S "Transarctic 1989-1991" data.

Aeromagnetic data over the Podvodnikov Basin define several more or less linear, E-W trending features which have no expression in the bathymetry. The character and geometry of these magnetic anomalies compares well with those related to Cretaceous sea-floor spreading (Kovacs et al, 1999). A spreading center is inferred along the Arlis Rise with an age of 128 Ma (anomaly M7) and a spreading velocity c. 25 mm/year.

It can be concluded that the Podvodnikov Basin has unusually thick crust for a deep-ocean basin and some features suggesting an origin by sea-floor spreading. However, the crustal layer with a V_p of 6.1–6.3 km/sec may indicate the presence of highly attenuated and underplated continental crust.

References:

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