

ГЕОЛОГИЯ И ГЕОФИЗИКА
GEOLOGY AND GEOPHYSICS

<https://doi.org/10.30758/0555-2648-2021-67-4-382-393>
УДК 551.35:550.834(269.46-16)



ОРИГИНАЛЬНАЯ СТАТЬЯ

ORIGINAL ARTICLE

CURRENT-CONTROLLED SEDIMENTATION
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Summary

The sedimentary basins of the north-western Weddell Sea are characterized by a variety of contourite drifts. This study is aimed at their identification, spatial mapping and temporal evolution and based on the integration of a large amount of seismic data collected by different countries including the recent data of the Russian Antarctic Expedition. Most of the drifts in the region being studied are classified as separated, confined, plastered or sheeted. The chain of sediment wave fields is mapped in the western and northern Powell Basin. The earliest contourite drifts started to form in the Early Miocene or, possibly, in the Late Oligocene. The changes in the depositional pattern in the Middle Miocene and then in the Late Pliocene are thought to have resulted from successive intensification of the bottom currents.

Keywords: Antarctic, bottom currents, contourite drift, Jane Basin, Powell Basin, seismic research, seismic stratigraphy, Weddell Sea.

For Citation: *Leitchenkov G.L., Minina V.V., Guseva Yu.B.* Current-controlled sedimentation in the north-western Weddell Sea. *Problemy Arktiki i Antarktiki*. Arctic and Antarctic Research. 2021, 67 (4): 382–393. <https://doi.org/10.30758/0555-2648-2021-67-4-382-393>.

Received 14.10.2021

Revised 16.11.2021

Accepted 22.11.2021

INTRODUCTION

Bottom currents impact sedimentation processes in that they can form contourite drifts that reach hundreds of km in length, tens of km in width and 2 km in thickness [1]. Contourite drifts are seismic facies generally formed in the deep-sea basins, along continental margins due to the force of the bottom currents [2]. Buried contourite drifts, lying at different stratigraphic levels, allow interpreting the direction and energy (relevant speed) of the bottom currents in the geological past.

Contourite drifts can be classified as separated, confined, plastered or sheeted depending on their morphology and depositional environments [3]. Separated drifts develop at the foot of steep slopes and are separated from the slope by channel-like features (often called moats

in scientific literature), representing the flow-path of the bottom current. Confined drifts are deposited in confined conditions in between bottom uplifts and can have a slightly convex shape. Plastered drifts are found on gentle slopes swept by bottom currents. Sheeted drifts cover wide areas and have a slightly mounded relief, thinning out towards the margins. They are characterized by low-amplitude discontinuous reflectors [4]. Contourite drifts do not have distinct boundaries and often undergo a smooth transition from one type to another [2]. Drifts can rework turbidites, thus forming a mixed type of deposits.

Drift morphology is controlled by the basin relief, speed and duration of the bottom current, and the amount of the transported sediments [2]. Changes in the oceanographic conditions are reflected in the seismic record within the contourite drift body [5]. Large-scale drifts usually migrate in the direction of the bottom current flow. In certain cases, bottom currents form bedforms known as sediment waves. However, the presence of sediment waves in general is not diagnostic of contourite drifts as they can also be formed by turbidity flows [3]. If a current intensifies (often along steep slopes), it can lead to the absence of sedimentation along the current core or even to the surface erosion [2]. The main aim of this paper is to study along-slope sedimentation processes in the north-western Weddell Sea (Fig. 1), to map the areal distribution of the contourite drifts and to reconstruct the water-mass circulation pattern in this region in the Late Cenozoic through the analysis of contourite drift parameters and distribution.

The north-western Weddell Sea includes four sedimentary basins: the younger part of the Late Mesozoic to Cenozoic Weddell Sea Basin, the northernmost extremity of the Larsen Basin located on the Antarctic Peninsula margin, the Powell Basin and the Jane Basin. The

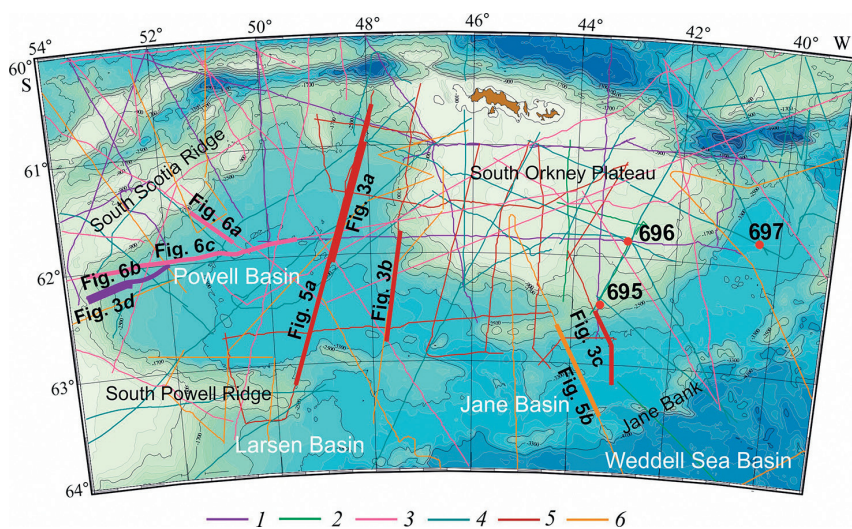


Fig. 1. Multichannel seismic profiles collected by different countries in the north-western Weddell Sea. Thickened lines show position of seismic sections presented in Figs. 3, 5 and 6.

1 — Japan, 2 — United Kingdom, 3 — Italy, 4 — USSR, 5 — Russia, 6 — Spain. The red dots with numbers are drill-holes of the Ocean Drilling Project (ODP)

Рис. 1. Сейсмические профили МОВ ОГТ, выполненные разными странами в северо-западной части моря Уэдделла. Утолщенными линиями показано положение сейсмических разрезов, которые демонстрируются на рис. 3, 5 и 6.

1 — Япония, 2 — Великобритания, 3 — Италия, 4 — СССР, 5 — Россия, 6 — Испания. Красной точкой показаны скважины, пробуренные по проекту глубоководного бурения

latter two formed in the back-arc geodynamic settings as a result of the convergence of the lithospheric plates in the Late Eocene — Miocene [6]. The sea-floor spreading in the Powell Basin lasted from ca. 30 to 22 Ma [7], and in the Jane Basin — between 20 and 14.5 Ma [6]. On the north and the west, the basins are bordered by the submerged continental blocks of the South Orkney Plateau and the South Scotia Ridge. The Jane Basin is separated from the Weddell Sea Basin by the Jane Bank representing a paleovolcanic arc (Fig. 1).

The research area is covered by quite a large number of seismic profiles, collected by different countries over the last few decades, and 3 boreholes were drilled there within the Ocean Drilling Program (ODP) Leg 113 [8] (Fig. 1).

OCEANOGRAPHIC FEATURES

The depths in the Powell and Jane Basins range between 2 500 and 3 500 m (Fig. 1). The eastern part of the Powell Basin and the Jane Basin are characterized by numerous basement rises and ridges. The chain of elongated ridges at the southern border of the Jane Basin is a magmatic arc, known as the Jane Bank (Fig. 1). The north-western Weddell Sea is involved in the cyclonic (clock-wise) water circulation of the Weddell Sea known as the Weddell Gyre, which is controlled by the prevailing winds and basin relief [9] (Fig. 2). A proto-Weddell Gyre might have already existed from the Early Oligocene and could have formed as a result of the Drake Passage opening [9]. The water mass in the north-western part of the Weddell Gyre is composed of 3 layers. The upper layer is represented by the surface water; a layer of deep waters lies below it, and water masses deeper than 2 000 m represent the Weddell Sea Bottom Waters (WSBW) [10, 11].

The WSBW are generated in the southern Weddell Sea, where the meltwater from the Ronne and Filchner ice shelves cools down the ocean water, which sinks to approximately 2 000 m depths and mixes with the lower fraction of the Antarctic Circumpolar Current (ACC) [11]. The Powell basin is swept by one of the fractions of the WSBW: the water moves clock-wise and leaves the basin through the gaps at the northern margin. The Jane

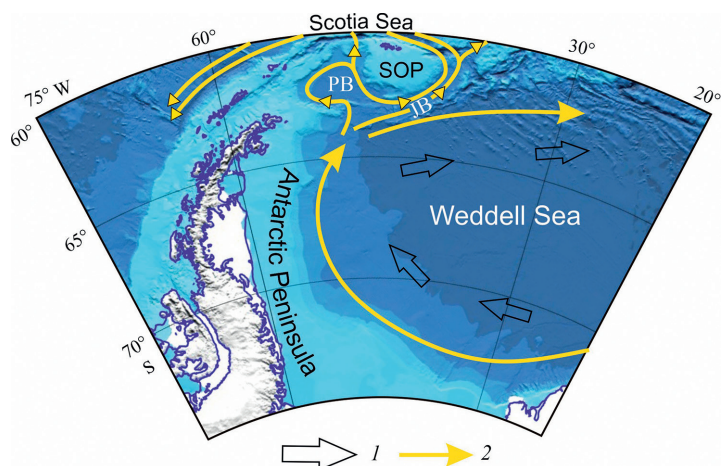


Fig. 2 Water circulation in the north-western Weddell Sea (Modified from [10]).

1 — Weddell Sea Gyre, 2 — Weddell Sea Bottom Waters. PB — Powell Basin; JB — Jane Basin, SOP — South Orkney Plateau

Рис. 2. Схема водной циркуляции в северо-западной части моря Уэдделла (по [10] с изменениями).

1 — Круговорот Уэдделла, 2 — донные воды моря Уэдделла. PB — бассейн Пауэлл, JB — бассейн Джейн, SOP — Южно-Оркнейское плато

basin is swept by another fraction of the WSBW, which moves along the foot of the South Orkney Plateau and passes into the Scotia Sea. The main WSBW branch flows along the Jane Bank into the Weddell Basin [10] (Fig. 2). Deep-water circulation is crucial in the contourite drift formation [3]. Bottom currents are driven by thermohaline, wind or tidal forces and may occur on the shelf, slope and in the basin environments [12]. When bottom currents flow along isobaths, they can also be referred to as contour currents.

SEISMIC STRATIGRAPHY AND DRIFT DEVELOPMENT (PRIOR RESEARCH)

Different seismostratigraphic models have been suggested for the north-western Weddell Sea. King et al. [13] have described 2 units in the post rift sedimentary cover. They suggest that the upper unit has developed since the Late Miocene in conditions of the growing Antarctic glaciation and under the influence of the bottom currents. A more detailed description was made by Coren et al. [14], who distinguished 4 seismic units. The two upper units in their seismostratigraphic model formed in the Early Miocene — Early Pliocene and Early Pliocene — Quaternary, accordingly. The authors did not suggest the genesis of the units.

Viseras and Maldonado [15] identified 5 seismic units and 10 seismic facies within the Powell Basin, representing different stages of the basin evolution and environment changes. According to their interpretation, the 3 upper units formed under the influence of the Antarctic Peninsula glaciation and terrigenous sediment input since the Early Miocene (ca. 21 Ma). The boundaries between the units represent episodic global cooling in the Late Miocene and Late Pliocene. Gravity flows are well-developed within the 3 upper units [15]. The authors link the contourite drifts formation to the development of the Antarctic Bottom Waters (AABW) from the Early Miocene [15].

Maldonado et al. [10] identified 4 regional seismic reflectors (horizons) — “a”, “b”, “c”, “d” in the north western Weddell Sea. They used depositional rates of the surface sediment cores and the ODP boreholes for chronostratigraphic interpretation and estimated the ages for these horizons (up-section from “d” to “a”) as 18, 12.2–12.0, 7.2–6.5 and 3.7–3.3 Ma. The authors also presumed that the bottom currents were initiated in the Early Miocene and intensified in the Late Miocene. They note that, in contrast to the Powell Basin, gravity flows are poorly developed in the Jane Basin.

The contourite drifts in the north-western Weddell Sea have been previously described in several studies [10, 11, 16]. Pudsey [11] suggests that the contourite drifts in the Powell Basin are located at its margins, while the central part is covered by turbidites. Maldonado et al. [10] identified a variety of drifts in the Jane Basin including basement/tectonic controlled drifts (as a specific new type), which result from the irregularities of the basement surface. According to Pudsey [11], the contourites in the north-western Weddell Sea are mostly fine-grained, except for the NW margin of the Larsen basin, where they are comprised of sandy sediments. In the north-western part of the Powell Basin, fields of sediment waves were revealed [11, 13, 16].

METHODS

The study is based on the multichannel data collected in 2018 by the Russian Antarctic Expedition (RAE) using the RV “Akademic A. Karpinsky”, as well as data from Italian, Spanish, British and Japanese expeditions, available from the Antarctic Seismic Data Library (SDLS, <https://sdls.ogs.trieste.it>). Additionally, paper copies of seismic sections acquired in 1990 by the Marine Arctic Geological Expedition [17] were used for joint interpretation.

The recently collected Russian multichannel seismic data were acquired using DigiSTREAMER 2D seismic equipment. The length of the streamer was 7000 m with 560 seismic channels located 12.5 m apart. Seismic data processing included the following stages: velocity analysis (every 5 km), stacking, amplitude recovery, band pass filtration

(6–8–80–120 Hz) and automatic gain control. Parameters of data acquisition and data processing for other surveys can be found on the SDLS website (<https://www.scar.org/sdls/>). The seismic profiles were interpreted in the Kingdom software.

RESULTS

The sedimentary cover is spread unevenly within the basins and reaches 2.5–3 km in thickness. Previously suggested seismostratigraphic models have been revised based on the new seismic data collected in the Russian Antarctic Expedition and analysis of all the other available seismic profiles. As a result, 7 seismic horizons have been identified in the north-western Weddell Sea: P1, P2, PJ3, PJ4, PJ5, PJ6, PJ7 (the P index is used for the Powell Basin, J — for the Jane Basin and PJ — for both basins if the horizons are traced continuously). The horizon ages were presumed on the basis of the drilling data, the main tectonic and paleogeographic processes in the region evolution [7, 8] and following the interpretation by Maldonado et al. [10]. The horizons P1 and J1 are break-up unconformities and correspond to the start of sea-floor spreading at approximately 30 Ma in the Powell Basin and 20 Ma in the Jane Basin, respectively. The formation of P2 is linked to the end of

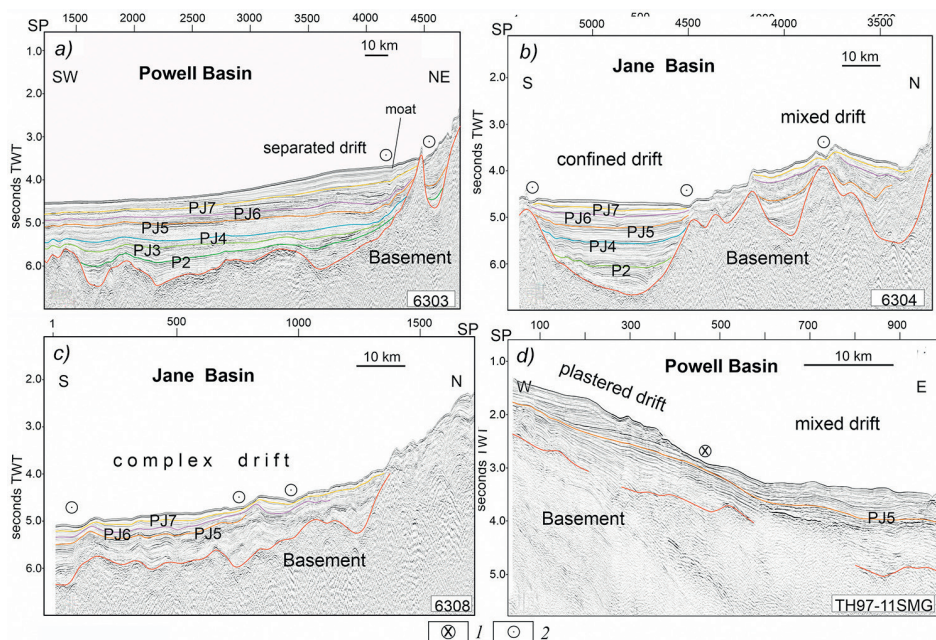


Fig. 3. Seismic stratigraphy and types of contourite drifts in the Powell and Jane basins: separated drift (a), confined and basement-controlled drift (b), sheeted drift (c), plastered and mixed drifts (d). See Fig. 1 for location.

1 — bottom currents flowing from the observer, 2 — bottom currents flowing towards the observer. Ages of seismic horizons: P2 — 20 Ma, PJ3 — 18 Ma, PJ4 — ca. 14.5 Ma, PJ5 — 14.0–12.0 Ma, PJ6 — 7.2–6.5 Ma, PJ7 — 3.7–3.3 Ma. The original names of the seismic profiles are shown at the lower right corners of the seismic sections

Рис. 3. Сейсмическая стратиграфия и типы контуритовых дрифтов в бассейнах Пауэлл и Джейн. Положение профилей показано на рис. 1

1 — донные течения, направленные от наблюдателя, 2 — донные течения, направленные к наблюдателю. Возрасты сейсмических горизонтов: P2 — 20 млн лет, PJ3 — 18 млн лет, PJ4 — 14,5 млн лет, PJ5 — 14,0–12,0 млн лет, PJ6 — 7,2–6,5 млн лет, PJ7 — 3,7–3,3 млн лет. В правом нижнем углу каждого разреза указано название профиля

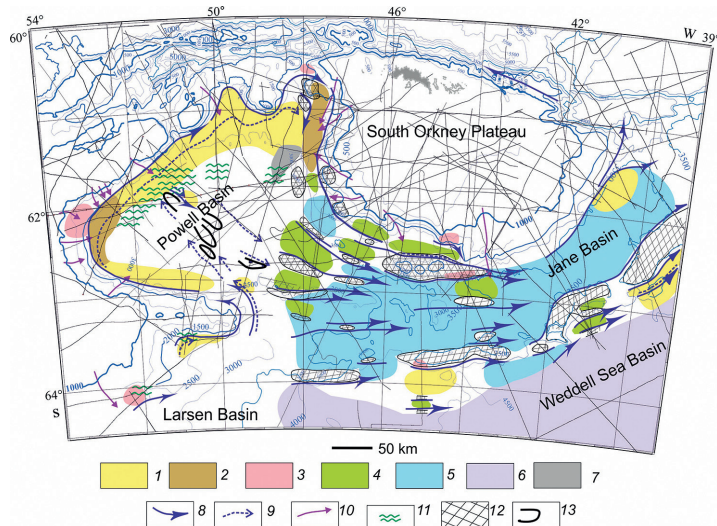


Fig. 4. Distribution of moats and recent contourite drifts in the north-western Weddell Sea.

1 — separated drifts, 2 — mixed drifts, 3 — plastered drifts, 4 — confined drifts, 5 — system of current-controlled deposits with prevalence of sheeted drifts, 6 — sheeted drifts, 7 — debris flow deposits overlain by the horizon PJ6, 8 — moats and direction of focused bottom currents, 9 — paleomoats (see Fig. 6 for their stratigraphic position) and direction of bottom paleocurrents, 10 — modern submarine channels, 11 — fields of sediment waves (developed mostly above the horizon PJ6), 12 — deep-sea ridges and rises, 13 — buried ridges/rises. Notes: the sketch shows recently formed and modern contourite drifts which are expressed in the sea bottom, but most of them inherit older drifts

Рис. 4. Схема распространения каналов и молодых контуритовых дрифтов в северо-западной части моря Уэдделла.

1 — отделенные дрифты, 2 — смешанные дрифты, 3 — пластерные дрифты, 4 — ограниченные дрифты, 5 — осадки, накапливавшиеся под действием донных течений разной интенсивности, с преобладанием покровных дрифтов, 6 — покровные дрифты, 7 — отложения обломочных потоков (под границей PJ6), 8 — каналы и направления сфокусированных придонных течений, 9 — палеоканалы и направления палеотечений, 10 — современные подводные каналы, 11 — поля осадочных волн, 12 — глубоководные поднятия, 13 — погребенные хребты/поднятия. Показанные контуритовые дрифты проявлены в морском дне и имеют относительно молодой возраст, но практически везде наследуют более древние контуриты

spreading in the Powell Basin and the start of spreading in the Jane Basin at approximately 20 Ma. PJ3 corresponds to the reflector “d” of [10]. It represents an erosional surface and can reflect the intensification of the bottom currents in the area at approximately 18 Ma.

The horizon PJ4 has not been identified before. It is a continuous boundary marking a visible change in the seismic pattern. PJ4 onlaps the extinct ridge in the Jane Basin and so can correspond to the end of sea-floor spreading at approximately 14.5 Ma [6]. The horizon PJ5 marks the changes in the acoustic pattern, which are thought to have been caused by transition from temperate/cold to polar conditions in Antarctica and the glaciation of West Antarctica 14–12 Ma [8], i. e., we believe that the age span for this horizon is wider than that proposed by [10]. The horizons PJ6 and PJ7 in our model are similar to those identified by [10], and they are labeled “b” and “a”, respectively, so we suggest the ages 7.2–6.5 and 3.7–3.3 Ma for them.

Contourite drifts of different types are widely distributed in the north-western Weddell Sea and well-recognized from seismic data (Fig. 3). In the Larsen Basin (only its northernmost part has been studied), small plastered and separated drifts are identified on the continental slope (between isobaths 1000–2300 m) and at the foot of the slope (between isobaths 2300–2800 m), respectively (Fig. 4).

The Powell Basin is dominated by large 30–50 km-wide separated drifts occupying its western and northern margin (Fig. 4, 5a). The paleo- and modern moats are continuously traced along the foot of the continental slope showing the migration of their axes up-section toward the slope. The moat/drift system started to form below the horizon PJ4, whose age is suggested to be approximately 14.5 Ma (Fig. 6a). The earlier clear indications of current-controlled structures (moat and separated drift) are observed along the buried NW-SE-striking basement ridges in the central part of the Powell Basin (Fig. 4). They are observed above the horizon PJ3, within the Early Miocene sedimentary unit, but their development can be assumed to have taken place above the basement at an age of approximately 25–24 Ma, determined on the basis of magnetic anomaly identification [7] (Fig. 6c). The southern part of the Powell Basin shows lesser sedimentary thickness for all units and especially for the post-Middle Miocene succession above the horizon PJ5 (Fig. 6a).

We have also mapped sedimentary bodies with a complex internal acoustic pattern. They replace separated drifts in some local places where submarine channels occur and are thought to have formed through the interaction between the bottom currents and turbidity flows (Fig. 3d, 4). Two small plastered drifts (up to 50 km long, 10–20 km wide and 300–700 m thick) are locally developed in the north-eastern and south-western (Fig. 6b) corners of the Powell Basin, where the bottom currents change directions drastically providing input (plastering) of sediments on continental slopes.

The continental rise of the western and northern Powell Basin includes a field of sediment waves which stretches along a margin more than 100 km in length and has a width of approximately 50 km (Fig. 4). The waves are developed within the separated drift above the seismic horizon PJ6 (and even slightly deeper). In the western Powell

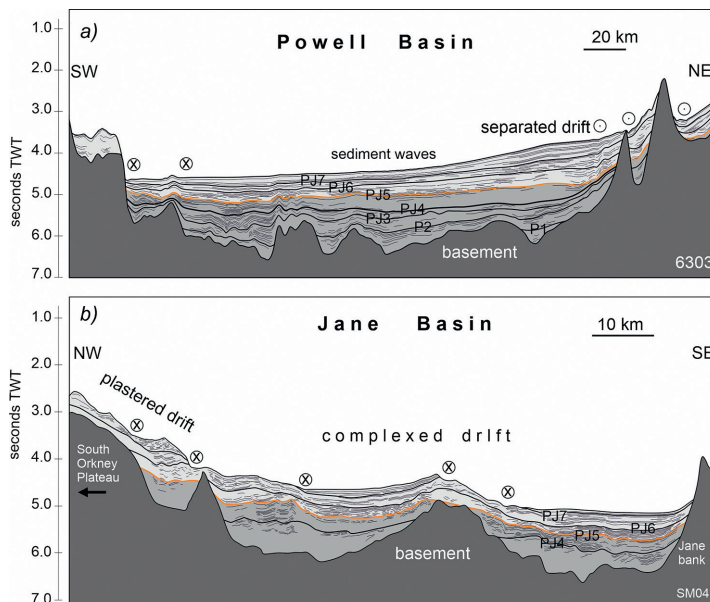


Fig. 5. Linedrawing sketches based on seismic sections across the Powell Basin (a) and Jane Basin (b). See Fig. 1 for location

Рис. 5. Интерпретированные сейсмические разрезы через бассейн Пауэлл (a) и бассейн Джейн (b). Положение профилей показано на рис. 1

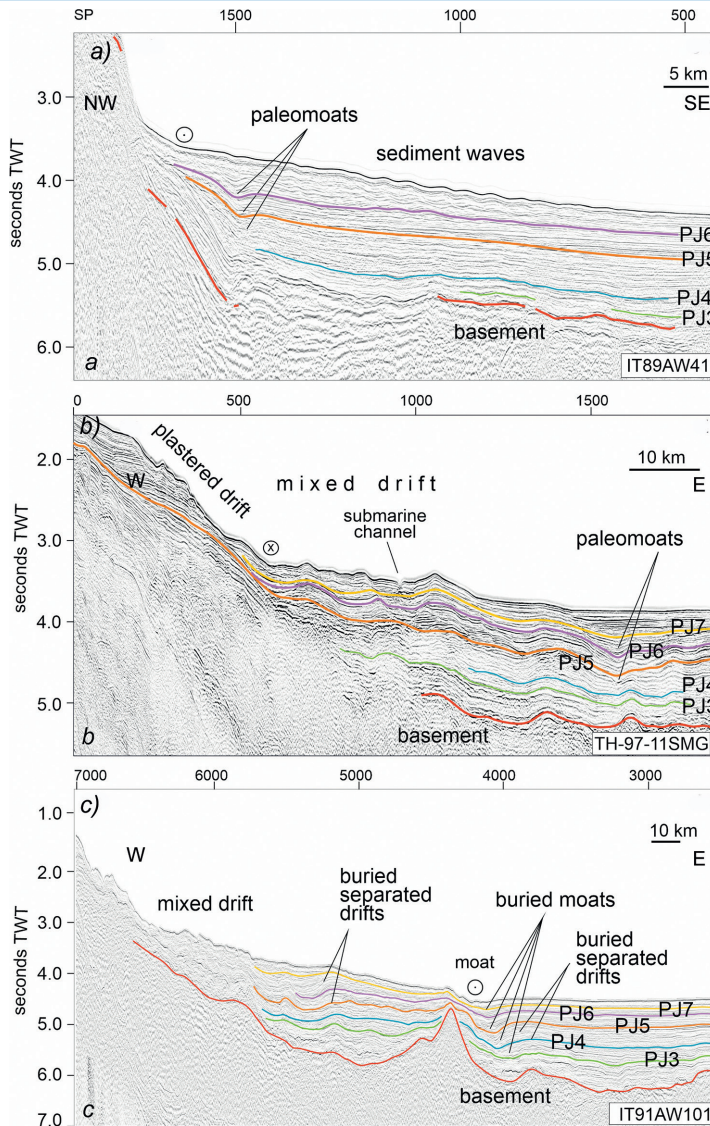


Fig. 6. Seismic stratigraphy and seismic facies in the Powell Basin. See Fig. 1 for location

Рис. 6. Сейсмическая стратиграфия и сейсмические фации в бассейне Пауэлл. Положение профилей показано на рис. 1

Basin, waves migrate upslope and have a wavelength of up to 2.5–3.7 km and a height of approximately 80 m (Fig. 6a). In the northern Powell Basin, they are less expressive, occur beyond the separated drifts, far from the focused current pathway, and show downslope (downstream) migration (Fig. 3a). The difference in the structure of the wave fields is likely to be linked to their position in relation to the core of the current stream.

Most of the Jane Basin is covered by current-influenced deposits which are difficult to classify in detail. Many of these deposits are controlled by pre-drift (mainly basement) morphology [10]; currents adapt to it, using and modifying negative forms in the bottom

relief, and can form elongated mounded drifts (Fig. 3*b*, 4, 5*b*). Along the steep slopes of the South Orkney Plateau and the Jane Bank, the current-controlled deposits evolve as separated drifts, the outer flanks of which can be transformed by the current streams (Fig. 3*b*, 4, 5*b*). In the axial part of the Jane Basin (especially in its eastern half) the drifts are close to the sheeted type with almost parallel internal reflectors and subdued external morphology (Fig. 5*b*). This drift system covers an area 90–100 km in width and stretches for more than 500 km from SW to NE. In the north-western part of the Jane Basin, the several 15–30 km wide confined drifts occur within the narrow depressions bordered by basement highs (Fig. 3*b*, 4).

In the Weddell Sea Basin, along the Jane Bank, the drift structure is variable depending on the basement morphology and the pattern of bottom currents. A slightly mounded, ca. 30 km wide contourite drift paired with a deeply-incised moat at the foot of the steep Jane Bank slope is recognized on the single profile around 45° E. To the east, the drift shows a similarly mounded morphology but has a wavy structure with small deepenings (moats?) caused by the ragged basement relief. Further east, the local basement highs provide accommodation for the locally developed confined drift.

The easternmost part of the Weddell Sea Basin under study is distinguished by the existence of two parallel separated drifts (Fig. 4). One of them is developed along the steep slope of the Jane Bank, while the other is 15 km from it (see Fig. 5 in [10]). A 150 m-deep moat divides the drifts. They began to form immediately above the ca. 20 m. y. old oceanic basement dated from magnetic anomalies [6]. Southward of the elongated drift chain, the northern Weddell Sea Basin is occupied by sheeted drifts showing internal parallel reflectors.

Seismic data from all the basins studied show visible changes in the reflection pattern across the horizon PJ5 (ca. 12 Ma), with more expressive and diverse contourite drifts above this horizon (Fig. 3, 5, 6*a*, 6*b*). Some places are characterized by generation of moats (Fig. 3*b*, SP 488) above the horizon PJ5; a channel/levee system in the eastern Powell Basin has also formed at the same level (Fig. 6*b*); a field of sedimentary waves began to develop slightly later (between PJ5 and PJ6; Fig. 6*a*). The Late Pliocene horizon PJ7 marks a younger shift in sedimentation with more pronounced drift developments in all the basins (e. g. Fig. 3*b*, 3*c*, 5*a*, 6*b*).

DISCUSSION

Bottom currents played an important role in the formation of the sedimentary cover of the north-western Weddell Sea. The study of contourites can be used to assess the energy of modern and paleocurrents and reconstruct water circulation patterns. The moats and contourite drifts are well-recognized in the sedimentary succession and the moats mark the position of focused bottom currents. Spatial distribution of the moats allows us to reconstruct bottom water circulation.

The contourite drifts in the north-western Weddell Sea sweep broad sea-floor areas and are developed at different sea-floor depths ranging between 2000 m and 4500 m. The formation of the earliest drift deposits in the Powell Basin suggests that the deep-sea circulation initiated there immediately after the opening of the gateway between the South Orkney Plateau and the South Powell Ridge in the Late Oligocene, 24–23 Ma. Bottom currents entered from the Larsen Basin Sea into the Powell Basin bending around the W-E trending South Powell Ridge and circulated clockwise by a relatively broad front but focusing along the foot of the slope (Fig. 4, 5*a*). The Jane Basin did not exist at that time, and the bottom currents flowed to the east in the Weddell Sea Basin along the subduction

zone, which at that time existed at the foot of the South Orkney Plateau. The southern part of the Powell Basin with a reduced thickness of the sediments is characterized by subdued current-influenced deposition (or even non-deposition and erosion) as opposed to its western and northern parts. More pronounced differences in the depositional setting occurred after the Middle Miocene.

The Jane Basin opened as a back-arc structure from about 20 Ma to 14.5 Ma [6], and the bottom currents obviously flowed under the control of the sea-floor topography, although contourite drifts below the Mid Miocene horizon PJ5 are poorly distinguished. The contourite drifts variety above the horizon PJ5 denotes an intensification of the bottom currents likely due to the increased production of Weddell Sea Bottom Waters in the Middle Miocene as a result of a shift from temperate to polar climatic conditions in Antarctica. Later variation in the depositional style observed above the horizon PJ7 could have been caused by the Late Pliocene cooling trend, a reinforced deep-water production and intensification of the bottom current activity.

A bottom current pattern similar to the modern one was established after the completion of the tectonic activity in the north-western Weddell Sea in the Middle Miocene. Leaving the Larsen Basin, the modern bottom currents split into several branches which flow into the Powell Basin, Jane Basin and along the Jane Bank into the northern Weddell Sea Basin (Fig. 4). In the central and eastern Jane Basin, the currents are formed by the convergence of streams flowing from the Larsen Basin and the Powell Basin.

CONCLUSION

The north-western Weddell Sea including the Powell and Jane Basins is characterized by a wide development of contourite drifts of different types, with separated, confined, plastered and sheeted drifts predominating. They are observed at different depths ranging from 2000 to 4500 m. The western and northern margins of the Powell Basin are dominated by large separated drifts and sediment waves, while the southern margin does not contain deposits formed by bottom currents. The Jane Basin is covered by current-influenced deposits of different types, with sheeted drifts predominating. The formation of drifts in this area is controlled by ragged basement morphology. In the north-western part of the Jane Basin, confined drifts are developed within the narrow depressions bordered by basement highs. In the Weddell Sea Basin, the drift structure is variable, but sheeted drifts occupy most of the basin. Seismic data in all the basins studied show visible changes in the reflection pattern above the Middle Miocene and then in the Middle Pliocene horizons. These changes are believed to have been caused by intensification of bottom currents. The moats, which are well identified in the modern sea floor and also as buried features, show the position and direction of active bottom currents.

Competing interests. The authors have no competing interests.

Конфликт интересов. Конфликт интересов отсутствует.

Funding. This work was supported by the Russian Foundation for Basic Research (grant № 19-05-00858).

Финансирование. Работа выполнена в рамках гранта РФФИ № 19-05-00858.

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КОНТУРИТОВЫЕ ДРИФТЫ В СЕВЕРО-ЗАПАДНОЙ ЧАСТИ МОРЯ УЭДДЕЛЛА

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Резюме

Контуритовые наносы, формируемые придонными течениями, могут использоваться для изучения циркуляции водных масс, так как по их параметрам и характеру распространения можно судить о направленности и относительной энергии придонных течений. В данной работе рассматриваются контуритовые наносы в северо-западной части моря Уэдделла, приводится схема распространения наносов и их классификация, а также реконструируется циркуляция водных масс в глубоководных бассейнах района. Исследования основаны на обобщении и интерпретации сейсмических данных отечественных и зарубежных экспедиций, большая часть которых доступна из международной библиотеки сейсмических данных по Антарктике. В результате анализа сейсмических данных в районе исследований в диапазоне глубин от 2000 до 4500 м выявлены отделенные, ограниченные, пластерные и покровные контуритовые наносы. Зарождение донных течений в северо-западной части моря Уэдделла началось с раскрытия бассейна Пауэлл, и развитие самых ранних контуритовых наносов предполагается 24–23 млн лет назад. В среднем миоцене и в позднем плиоцене отмечается усиление интенсивности донных течения и более широкое развитие контуритовых наносов.

Ключевые слова: Антарктика, донные течения, контуритовые дрефты, море Уэдделла, осадочный чехол, сейсморазведка.

Поступила 14.10.2021

После переработки 16.11.2021

Принята 22.11.2021

Для цитирования: *Leitchenkov G.L., Minina V.V., Guseva Yu.B.* Current-controlled sedimentation in the north-western Weddell Sea. Проблемы Арктики и Антарктики. 2021, 67 (4): 382–393. <https://doi.org/10.30758/0555-2648-2021-67-4-382-393>.

Контуритовые дрефты в северо-западной части моря Уэдделла (расширенный реферат)

Придонные течения оказывают существенное воздействие на процессы седиментации, так как под их влиянием могут формироваться осадочные тела — контуритовые дрефты, достигающие сотен километров в длину, десятков километров в ширину и до 2 км в толщину. Контуритовые дрефты (контуриты), формируемые придонными течениями, могут использоваться для изучения циркуляции водных масс, так как по их параметрам и характеру распространения можно судить о направленности и относительной энергии придонных течений. Настоящее исследование направлено на изучение условий осадконакопления в небольших по площади, задуговых осадочных бассейнах Пауэлл и Джейн, расположенных в северо-западной части моря Уэдделла, и главным образом — на идентификацию контуритовых дрефтов, выявление их пространственного развития и реконструкцию водной циркуляции этого района Антарктики в позднем кайнозое. Работа основана на обобщении и интерпретации сейсмических данных отечественных и зарубежных экспедиций, большая часть которых доступна в международной библиотеке сейсмических данных по Антарктике. В результате анализа сейсмических данных выявлен широкий спектр контуритов, развивавшихся в интервале глубин моря от 2000 до 4500 м. К ним относятся отделенные, покровные, ограниченные, пластерные дрефты и осадочные волны. В бассейне Пауэлл преобладает крупный отделенный дрефт, который формировался в виде крупной линзовидной осадочной структуры в борту канала, расположенного в подошве континентального склона и образованного донным течением. Здесь также установлены смешанные дрефты, образованные в результате взаимодействия турбидитных потоков и контурных течений. В бассейне Джейн преимущественно развиты покровные дрефты. Их форма во многом контролировалась расчлененным рельефом подстилающего кристаллического фундамента. На границе двух бассейнов выявлены ограниченные дрефты, образованные между поднятиями фундамента. Зарождение донных течений в северо-западной части моря Уэдделла началось с раскрытия бассейна Пауэлл, и развитие самых ранних контуритовых дрефтов предполагается 24–23 млн лет назад. В среднем миоцене и в позднем плиоцене отмечается усиление интенсивности донных течений и более широкое развитие контуритовых дрефтов.