

# The First Soviet High-latitude Expedition

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By the fall of 1934 *Glavsevmorput* (Chief Administration of the Northern Sea Route) could congratulate itself upon a fair degree of success with regard to progress in mastering the Northern Sea Route. During the 1934 season the ice-breaker *Fedor Litke* had finally managed to complete a one-season traverse of the Sea Route (Vize 1946; Belov 1969; Nikolayeva and Sarankin 1963), to some degree balancing the total failure of the *Chelyuskin* expedition of 1933 (Shmidt *et al.* 1935; Belov 1969) and the very limited success achieved by *Sibiryakov* in that direction in 1932 (Vize 1946; Shneyderov 1963). Moreover, as the outcome of a whole series of expeditions, bathymetry, ice and weather conditions were becoming increasingly well documented for the Barents, Kara, Laptev, East Siberian and Chukchi seas. However, there was still a vast gap in the knowledge of Arctic meteorology and oceanography with regard to conditions in the Central Arctic Basin, conditions which were of supreme importance to the navigation potential of the Northern Sea Route. Extremely valuable data had been accumulated by Nansen's expedition during *Fram's* drift in 1893-96 (Nansen 1897), but since then not a single expedition had achieved a systematic programme of scientific observations in the Central Arctic Basin.

Concerned as to this lack of basic data, and even intrigued as to the possibility of the feasibility of a northern variant of the Northern Sea Route, as early as January 1934 *Glavsevmorput* ordered the All-Union Arctic Institute to initiate investigation of the matter. A special committee of scientists led by Professor R.L. Samoylovich was formed, and within ten days it reported back to *Glavsevmorput* with a detailed plan for a high-latitude expedition (Belov 1969).

The committee proposed that the expedition should initially confine its attention to the western part of the Soviet Arctic (as far east as the meridian of the Lena delta). The proposed areas of scientific investigation included meteorology, ice observations, marine biology, physical oceanography, and investigation of seabed sediments (Belov 1969). In the first instance it was intended that the expedition should be mounted during the 1934 season, but for a variety of reasons (primarily that a suitable ship was not available) it was postponed until 1935.

The final version of the general plan for the expedition was outlined in the April issue of *Byulleten' Arkticheskogo Instituta* (Anonymous 1935). With G.A. Ushakov in charge of the expedition and N.M. Nikolayev in command of the ship, the icebreaking steamer *Sadko* was to put to sea towards the end of June with about 35 scientists on board. Heading first for Svalbard she would carry out oceanographic work in the Greenland Sea, then proceed eastwards, to the north of Svalbard, Zemlya Frantsa Iosifa and Severnaya Zemlya, implementing an

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oceanographic traverse along her entire route. What is perhaps most remarkable about this ambitious plan is that it was executed in almost every detail, apart from rounding the north side of Zemlya Frantsa Iosifa. The long-range ice forecast had predicted a favourable ice year, and, relying on that forecast, the *Sadko* expedition was to meet with almost unqualified success.

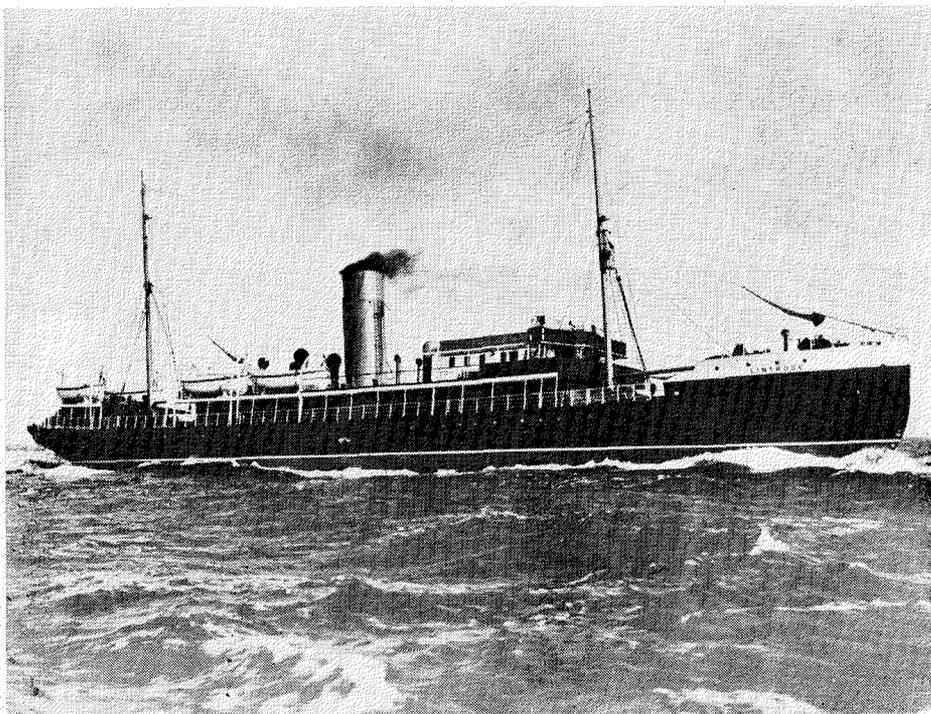


FIG. 1. The Reid-Newfoundland Company's icebreaking mail steamer *Lintrose* (subsequently the Soviet icebreaking steamer *Sadko*) on the Port-aux-Basques–Sydney run, 1913.

At this point, some further details about the ship, her commander and the expedition leader would seem appropriate. *Sadko*, originally named *Lintrose* (Fig. 1) was launched from the Neptune works of Swan, Hunter, Wigham Richardson Ltd. at Walker-on-Tyne, England, on 21 January 1913. The event was described in the *Newcastle Daily Journal* of 23 January 1913 (p. 3). She had been built for the Reid Newfoundland Company of St. John's, Newfoundland, to maintain the link between their rail terminus at Port-aux-Basques and North Sydney, Nova Scotia. In other words, along with her sister-ship *Bruce*, *Lintrose* was to act as Newfoundland's main link, winter and summer, with Canada. Since ice conditions in Cabot Strait can be extremely severe, of necessity both these vessels possessed quite impressive icebreaking abilities and considerable power for their size.

In the above-quoted report from the *Newcastle Daily Journal*, *Lintrose* is described as being "exceptionally strongly constructed for running through ice." In fact her plates were of 3.1 cm steel from her bows, which were of icebreaker

design, to halfway aft, and the remainder were of 2.5 cm steel (*Evening Herald*, St. John's, Newfoundland, 29 March 1913, p. 5). She was 77.7 m in length, 11.4 m in beam and had a draught of 6.4 m. Her machinery, installed at the Neptune Works, consisted of a single-screw triple-expansion engine supplied with steam from four boilers working on the Howden's forced-draught principle, delivering 3,500 horsepower (2,600 kilowatt). She had accommodation for 80 first-class and 150 second-class passengers. On her trials off the mouth of the Tyne on 12 March 1913 she achieved a maximum speed of slightly under 16 knots (30 km per hour) (Anonymous 1913).

After an extremely rough crossing which caused considerable damage to her superstructure, *Lintrose* reached St. John's on 29 March 1913. Long descriptions appeared in the local newspapers, replete with details such as the moroccan upholstery in the smoking saloon, or the mahogany sideboards and stained glass doors in the dining saloon. But at the same time they did not overlook such pertinent technical details as her double hull, her five watertight compartments; and the special design of her condenser intake located in a special tank between the hulls with access to the sea via a series of holes in the outer hull, and equipped with steam nozzles in case slob ice should get into the tank (*Evening Herald*, St. John's, Newfoundland, 29 March 1913, p. 5).

*Lintrose* began her regular run immediately and provided sterling service between Port-aux-Basques and Sydney, winter and summer, for almost two years. Then early in 1915 she was sold to the Imperial Russian Government to assist in the struggle to maintain winter navigation to the port of Arkhangel'sk in order to supply vital war materials to the Russian military machine. The deal was closed on 28 January 1915 and *Lintrose* sailed for Arkhangel'sk on 1 February (*Evening Telegram*, St. John's, Newfoundland, 12 May 1915, p. 3).

For the remainder of that winter and throughout the following one, *Sadko*, as *Lintrose* had been renamed, was kept busy hauling supplies and escorting freighters from Aleksandrovsk-na-Murmane (now Polyarnyy) through the ice of the White Sea to Arkhangel'sk, along with several other ex-patriate Canadian and Newfoundland ships, several others of which — e.g., *Fedor Litke*, *Sibiryakov* and *Sedov* — would later win fame in the Soviet Arctic (Appleton and Barr 1976; Barr 1977a). In June 1916, largely because of her speed and comfortable accommodations *Sadko* was selected for a special mission; to take a government commission to Kandalaksha to inspect progress on the construction of the railway to the settlement later named Murmansk (Simonov 1935). On 20 June, while steaming at full speed in Kandalakshaya Guba she ran onto a submerged reef and sank in ten minutes as a result of a wide gash five metres long in her port side. She settled on the bottom on an even keel with the top of her funnel and her masts projecting above the water.

There she stayed for seventeen years. Not until 14 October 1933 was she finally refloated by a Soviet salvage team after strenuous efforts which had lasted two entire seasons (Simonov 1935). After she had been towed to Arkhangel'sk, the silt was cleaned out of her and she underwent a major refit during the winter of 1933-34. She was ready for action again in time for the following navigation season, and on the second series of sea trials of her career, on 9 July 1934, she achieved a speed

of 15.2 knots (28.2 km per hour) (Anonymous 1934). On 22 July 1934 she sailed from Arkhangel'sk on what might best be described as a working shake-down cruise: her tasks included the resupply of the weather station at Ostrov Domashniy off the west coast of Severnaya Zemlya and the building of another station at either Mys Olovyanni on Severnaya Zemlya or on Ostrov Uyedineniya (Gernet 1935; Laktionov 1935). In reality she ran into extremely heavy ice in the north-eastern part of the Kara Sea and was unable to achieve either objective; indeed she even had to call upon *Yermak* for assistance (Sorokin and Lur'ye 1951) in order to win free of the ice. Nonetheless she had more than adequately demonstrated her capabilities in Arctic ice.

At first sight the choice of G.A. Ushakov as leader of the 1935 expedition might seem a strange one, in that he was neither a sailor nor a scientist and had not taken part in any shipborne Arctic expeditions previously. However his credentials as an experienced *polyarnik* and as a determined expedition leader were extremely impressive. During the period 1926-29 he had led the first Soviet settlement on Ostrov Vrangelya under extremely difficult conditions (Mineyev 1946; Ushakov 1972; Barr 1977b). Then from 1930 to 1932 he had led the four-man expedition which had explored and mapped the Severnaya Zemlya archipelago in a remarkable series of dog-sledge traverses (Urvantsev 1935; Ushakov 1974; Barr 1975). Since then he had been appointed deputy director of *Glavsevmorput*.

N.M. Nikolayev, the officer selected to command *Sadko* on the 1935 expedition, was an Arctic navigator of vast experience, and had commanded *Fedor Litke* on three of her major expeditions. During the winter of 1931-32 he had taken her on a winter voyage in the Sea of Okhotsk to rescue several icebound ships (Nikolayeva and Sarankin 1963; Alekseyev 1935). The following summer he again took command of *Fedor Litke* as flagship of the Northeastern Polar Expedition, leading a convoy of seven vessels whose aim was to initiate development of the Kolyma Basin on a large scale. Due to severe ice conditions, the convoy was obliged to winter at Pevek in Chaunskaya Guba — hence Nikolayev had first-hand experience of an Arctic wintering (Nikolayeva and Sarankin 1963; Zinger 1948; Yevgenov 1933a; 1933b). Finally, in 1934 Nikolayev had been *Litke's* captain on her successful through-passage from Pacific to Atlantic.

*Sadko* sailed from Arkhangel'sk on 8 July 1935 (Belov 1969). According to plan, over-all command of the expedition was in the hands of G.A. Ushakov, and N.M. Nikolayev had command of the ship. Professor N.N. Zubov was in charge of the scientific programme, and the 28 scientists on board included such famous persons as N.I. Yevgenov (hydrographer), V.A. Berezkin, A.F. Laktionov and L.L. Balakshin (hydrologists); G.P. Gorbunov (biologist), and I.D. Zhongolovich (astronomer and magnetologist) (Belov 1969; Yevgenov 1935; Nikolayeva and Sarankin 1963; Chernenko 1962). The total complement including the ship's crew numbered 72 (Yevgenov 1935). The spacious passenger accommodation of the old *Lintrose* had been converted into a wide range of well equipped scientific laboratories (Belov 1969). Two aircraft had been loaded aboard for ice-reconnaissance purposes: a Shavrushka amphibian and a Heinkel floatplane; they would be piloted by aviators M.S. Babushkin and G.P. Vlasov respectively (Chernenko

1963; Karelin 1953). Food supplies sufficient for two years had been stowed in the holds, in case of a forced wintering. Also, to guard against that contingency several light, pre-fabricated huts and inflatable rubber boats had been included in the equipment. As a further precaution in case of wintering, *Sadko* carried 35 sledge dogs and three sledges, the responsibility of S.P. Zhuravlev, who had been the hunter and dog-driver on Ushakov's expedition to Severnaya Zemlya, and who had only recently returned from operating a hunting station on Bukhta Pronchishchevoy on the east coast of Poluostrov Taymyr (Karelin 1953; Zubov 1936; Yevgenov 1935).

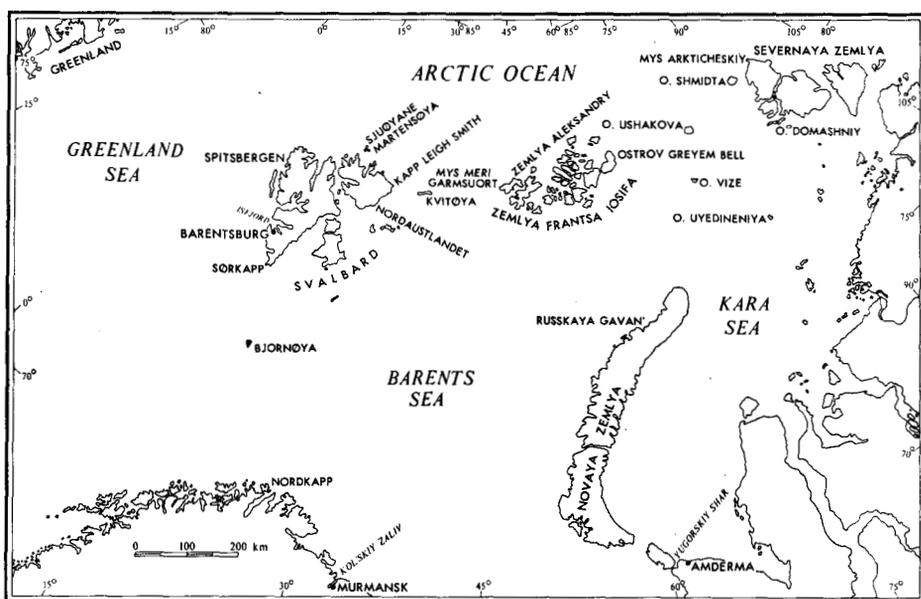


FIG. 2. Area covered by the expedition.

Captain Nikolayev first set a course for Murmansk, where some final items of equipment were loaded, then on 12 July again cast off and steamed north down Kol'skiy Zaliv and west to Nordkapp (Fig. 2) (Karelin 1953; Chernenko 1963; Yevgenov 1935). Dropping that landmark astern, Nikolayev headed north past Bjørnøya to Svalbard. An oceanographic station was occupied every 30 miles (48 km). Inevitably such stations dictated the routine and the tempo of the whole voyage. The dark cliffs and snowcapped peaks of Spitsbergen were sighted on 17 July.

At Sørkapp Nikolayev swung *Sadko* due west to begin a series of oceanographic traverses across the Greenland Sea. She steamed along the seventy-sixth parallel in completely ice free waters (Karelin 1953; Chernenko 1962; Belov 1969; Yevgenov 1935), crossing first the Greenwich meridian, then the 5°W meridian. Not until well west of the 8°W meridian was ice spotted in the form of a solid line of brilliant greenish-white floes dead ahead—the constant stream of ice being evacuated from the Arctic Basin by the East Greenland Current. *Sadko*

swung north along the ice edge as far as the seventy-eighth parallel, then turned east again and carried out another traverse of stations along the parallel back to the Svalbard coast (Karelin 1953; Chernenko 1963).

Chernenko (1963) has superbly captured the atmosphere of these Arctic oceanographic stations: the ship's bell ringing to announce that the site for the next station had been reached; a sailor rushing round the cabins rousing out not only the scientists but also practically every available body; and journalists, movie-cameramen and pilots all lending a hand with winches, bathymeters, trawls, plankton nets or bottom corers. The time taken to complete a station would vary greatly: one hour or 90 minutes in shallow water, up to six hours in depths of over 3,000 metres in the centre of the Greenland Sea. The schedule of stations was adhered to rigorously, despite sea conditions or weather. Hence the men at the winches and on the cables would frequently be soaked by waves breaking over the rail, or thrown about by the lurchings of the ship in a lumpy sea. Captain Nikolayev, who was always on the bridge during a station, would do his best to hold the ship in position, and to create a lee in which the scientists could work relatively comfortably — but despite his best efforts the oceanographic stations frequently meant thorough drenchings in bitterly cold water for the men involved.

Once a station was completed *Sadko* seemed to be capable of covering 30 miles (48 km) in an incredibly short time. Scarcely had the men had time to stow away instruments and samples, preserve the biological specimens, grease the winch, grab some food and drink, and perhaps some sleep, when the bell would ring for the next station, and the orderly would again be banging on cabin doors.

On 22 July, *Sadko* reached the Soviet coal-mining settlement of Barentsburg on Isfjorden (Chernenko 1963; Karelin 1953; Yevgenov 1935). She was given an enthusiastic welcome and all off-duty personnel were taken on a tour of the mines. Meanwhile bunkering of the *Sadko* began, and engineers from the mines helped overhaul her engines. The two aircraft were lowered into the water and made a few trial trips. Just prior to *Sadko*'s departure, on 29 July, the miners presented the ship with a superb cake, decorated with the message "Greetings to *Sadko*," the work of the resident pastry-cook (Chernenko 1963).

On leaving Isfjorden *Sadko* pushed west once more, to run yet another traverse as far as the pack ice would allow. Ice was spotted on 31 July approximately at the eightieth parallel, and as the ship forged steadily westwards the ice became progressively heavier. On 2 August the ship swung back on an easterly course. In the area northwest of Svalbard the soundings revealed the relatively shallow Nansen Ridge, a submarine formation running from Svalbard to Greenland and separating the deep central basin of the Arctic Ocean from the Greenland Sea (Chernenko 1963; Karelin 1953).

*Sadko*'s eastward course, through easily passable ice, took her close past the Sjuøyane, associated with such epic endeavours as the attempts to reach the North Pole made by Phipps aboard *Rasehorse* and *Carcass* in 1773 (Phipps 1774), and by Parry on his fourth voyage aboard *Hecla* in 1827 (Parry 1828), and *Krasin*'s rescue of the *Italia* survivors in 1928 (Nobile 1930; Samoylovich 1934). At first sight the route past the northern coasts of Nordaustlandet appeared to be blocked by close ice; Babushkin flew an ice reconnaissance with Captain Nikolayev as

observer, but they failed to locate a practicable route east. However Nikolayev was able to make numerous important corrections to the map of Nordaustlandet (Chernenko 1963). Later the same day G.P. Vlasov, with I.D. Zhongolovich as observer, flew another reconnaissance, this time with greater success: they spotted a feasible route leading east. *Sadko* again forged ahead, although as a precaution Nikolayev ordered the lead cast every three minutes. Off the northwestern tip of Martensøya the zone of passable ice between heavy multiyear ice to the north and the coast to the south narrowed to 700 metres in width, and at one point, as *Sadko* squeezed past a projecting cape, depths decreased to 60 metres. On 6 August, she safely reached Kapp Leigh Smith (Karelin 1953); the north coast of Svalbard had been successfully rounded.

Deliberately, Ushakov lingered in the area of Kvitøya. The pilot Levanevskiy was planning to make a transpolar flight, and by providing weather information *Sadko* could be of great assistance (Belov 1969). During this period, radiosondes were sent up twice per day, and up to three synoptic weather charts were compiled daily (Zubov 1936). In fact, however, Levanevskiy's transpolar flight was postponed. In the meantime, both of *Sadko*'s aircraft made aerial photographic survey flights over northeastern Nordaustlandet, as a result of which significant corrections were made to the map of the area (Chernenko 1963).

From Kapp Leigh Smith *Sadko* set off northwards on 7 August — her goal being to solve once and for all the mystery of “Gillis Land”, whose supposed existence was first reported by a Dutch captain, Cornelius Gillis in 1707, as recorded by Forster (1786) who stated that, having sailed north, then east, then southeast from Nordaustlandet, “at length at 25 leagues from thence, in 80 deg. he [Gillis] descried a very high land, which probably nobody had ever seen before him.”

Thereafter, for over three centuries, “Gillis Land” appeared as a dotted line on the charts. Frederick Jackson had kept a sharp eye open for it as he sledged along the ice cap above Mys Meri Garmsuort at the west end of Zemlya Aleksandry on 19 April 1897, but concluded that there was no such land at the location marked on the maps (Jackson 1899). Later that season, having evacuated his base camp at Mys Flora, Jackson took his ship *Windward* west to Mys Meri Garmsuort, thence northwestwards for 80 km on 7-8 August, without sighting land, to a point where soundings indicated a depth of 450 m. Jackson therefore concluded that his earlier finding had been confirmed.

During the British Arctic Expedition, which visited Svalbard and Zemlya Frantsa Iosifa in 1925 aboard the brigantine *Island*, Commander F.A. Worsley made a determined search for “Gillis Land” (which he specifically distinguished from Gilles Land, another name for Kvitøya). As *Island* headed northeastwards from Nordaustlandet in September 1925, a “strong appearance of land” was sighted to the north-northeast against the sunrise. The same phenomenon was seen again at midnight on the same bearing and with the same shape. Worsley felt certain that it was “Gillis Land,” although located west of the position marked on the chart (Worsley 1927).

Less than three years later, shortly before his tragic polar flight, Nobile had searched for “Gillis Land” during a preliminary flight aboard *Italia* eastwards

to Severnaya Zemlya on 15 May 1928 (Nobile 1930). The dirigible flew deliberately over the site of the supposed landmass with a visibility of some 15 km, but no land was sighted. Later that same year, during *Krasin's* second voyage in search of survivors from the crash of *Italia*, Captain Eggi specifically searched for "Gillis Land." At 6.20 p.m. on 19 September 1928, *Krasin's* position by dead-reckoning was  $81^{\circ}40'N$ ,  $36^{\circ}00'E$  — i.e., extremely close to the plotted centre of search. Although visibility was in excess of 32 km, no land was in sight, and a sounding indicated a depth of 200 m (Samoylovich 1934; Barr 1977c).

Despite these various negative results, and on the basis of reports made during visits to this same area aboard *Knipovich* in 1930, and *Persey* in 1934, Captain Nikolayev was convinced that he had twice seen "something resembling land" (Chernenko 1963). Professor Zubov had also taken part in these expeditions, but although many of the expedition members aboard *Persey* in 1934 claimed to have seen land, he remarks (Zubov 1936) that "it was impossible to vouch for this." Nonetheless, on the basis of ice distributions, he too was inclined to believe that "Gillis Land" did indeed exist.

Having reached the general area of the supposed landmass, *Sadko* occupied an oceanographic station on 13 August, while G.P. Vlasov flew a reconnaissance to the north (Chernenko 1963). On his return he reported that dense fog had prevented him from flying very far. Further flights by M.S. Babushkin on 14 August with Ushakov as observer, and on the following day by Vlasov with navigation officer Markov as observer, produced almost identical and equally inconclusive results. Babushkin reached the eighty-second parallel, but dense fog to the north and east could well have concealed a landmass (Yevgenov 1935; Chernenko 1962).

By this time *Sadko* had drifted with the ice to a latitude of  $81^{\circ} 23'N$  (Karelin 1953) and ice conditions were deteriorating. Reluctant to endanger his ship for the sake of the elusive landmass, Nikolayev headed south past the eastern end of Kvitøya, and soon *Sadko* emerged into open water. A radio message was received from the collier *Spartak* to the effect that she was lying at Russkaya Gavan' in northern Novaya Zemlya with coal for *Sadko*. The ship was therefore set on a direct course across the Barents Sea for that destination (Belov 1969; Yevgenov 1935; Zubov 1936; Karelin 1953; Chernenko 1963).

*Sadko* reached Russkaya Gavan' on 21 August, and coaling began immediately; three days later, with full bunkers she put to sea again, northward bound, to explore the unknown northern limits of the Kara Sea. On 26 August she passed close to Ostrov Vize in thick fog (Karelin 1953), and three days later was approaching the eastern tip of Ostrov Greyem Bell, which had been named and explored, but not accurately surveyed, by members of the Wellman expedition in the spring of 1899 (Wellman 1899). At 6.35 a.m., as *Sadko* lay against the edge of the fast ice a little to the south of the northeastern tip of the island (Yevgenov 1935), Nikolayev sent a party ashore across the fast ice to build a beacon and to carry out scientific investigations (Chernenko 1963). Even before they had reached shore, however, ice packing against the fast ice under the influence of a northerly wind forced Nikolayev to hoist a recall signal. As soon as the party was safely back on board, he manoeuvred *Sadko* out of a potentially dangerous situation and headed north. It so turned out that the shore party had been recalled just in time;

as soon as the ship got under way, dense fog and driving snow reduced visibility to zero.

*Sadko* next headed east, then at longitude  $72^{\circ}\text{E}$  she swung north. Steadily increasing depths were sounded — soon exceeding 600 m — for the ship was now above the continental slope. But at latitude  $81^{\circ}38'\text{N}$  northward progress was blocked by heavy pack ice, and Captain Nikolayev was forced to swing east, then south. Depths sounded quickly decreased to less than 200 m again (Yevgenov 1935).

Soon after this, a noteworthy event was carefully recorded by Nikolayev (Chernenko 1963 pp 158-9):

On the evening of 1 September, on emerging into open water at  $80^{\circ}55'\text{N}$ ,  $79^{\circ}00'\text{E}$  at 7.20 p.m., dead ahead through the fog we sighted a coast covered with ice. Proceeding at slow speed, at 8.00 p.m. we anchored in a depth of eight fathoms, three-four cables from shore. The land we had discovered turned out to be an island covered with an ice cap. . . .

On 2 September at 3.20 a.m. I took off with pilot Vlasov aboard the aircraft *Sh-2* to explore the island. It was oval in shape, about 25 km long and 15-17 km wide, and the height of the ice cap in its central part was 250-300 m. A party which went ashore shot a bear on the island. At 7.00 a.m. they determined the position to be  $80^{\circ}59'\text{N}$ ,  $79^{\circ}10'\text{E}$ . At 11.30 a.m. we weighed anchor and began a marine survey of the island.

The landing which Nikolayev describes was not achieved without some difficulty. A first attempt ended in failure when the landing party was met at every attempted landing site by sheer, or even overhanging, ice cliffs. On the second attempt a small bay with a shelving beach was discovered.

The island was named Ostrov Ushakova after the expedition leader (Chernenko 1962). Its discovery represented a personal triumph for hydrologist V.A. Berezkin, who had hypothesized the existence of land to the northeast of Ostrov Vize on the basis of the currents recorded in the northern Kara Sea by *Sedov* in 1930 and by *Taymyr* in 1932 (Karelin 1953). As *Sadko* steamed south on 1 September, numerous angular (and hence freshly-calved) icebergs drifted out of the fog, suggesting the proximity of land. The discovery of Ostrov Ushakova had fully confirmed this hypothesis. The island lies on an extensive shallow bank, extending north-south from Ostrov Vize to Ostrov Ushakova and beyond, which has been named the Sadko Bank in honour of the expedition vessel (Yermolayev 1935).

On the evening of 2 September, Captain Nikolayev attempted to push north-eastwards from Ostrov Ushakova in case there were other islands in that direction. When the attempt was foiled by heavy ice, he set an easterly course towards Severnaya Zemlya. Off Mys Litvinova, on 8 September, two small islands were discovered, not marked on the map compiled by Urvantsev on the basis of his 1930-32 surveys (Zubov 1936; Chernenko 1963). *Sadko* next headed north and west in open water, with the aim of making a further latitudinal traverse at  $81^{\circ}\text{N}$ . But then a strong southerly wind arose; the seas did not become rough enough to endanger the ship, but the aircraft stowed on deck were at a half hour's readiness, and seas breaking over the ship might have damaged them badly. Nikolayev therefore headed at slow speed into the wind, and in a matter of 36 hours the ship

got back to Mys Litvinova (Zubov 1936; Karelin 1953; Yevgenov 1935). Swinging back on a northerly course, still with no ice in sight, *Sadko* soon recovered the lost ground. At dawn on 12 September, she passed the loaf-like ice cap of Ostrov Shmidta (Chernenko 1962), whose position was carefully plotted on the chart. Open water stretched away to the northward from Mys Arkticheskiy, the northernmost tip of Severnaya Zemlya. Ushakov and Nikolayev decided to grasp the unprecedented opportunity thereby offered to attempt to cross the continental slope and to carry out the first modern series of oceanographic observations in the Central Arctic Basin (Karelin 1953). *Sedov's* drift and Papanin's observations from *Severnnyy Polyus I* still lay two years in the future. Scientific knowledge of the Central Arctic Basin was confined to the relatively limited data collected by Nansen and his companions aboard *Fram* over 40 years previously.

Soon after *Sadko* had crossed the eighty-second parallel, a depth of 1,280 m was recorded; the continental slope lay beneath her keel. Shortly thereafter, she passed beyond the record high latitude for the Soviet Arctic of  $82^{\circ}29'N$ , which had been reached by *Malygin* in 1932 to the north of Zemlya Frantsa Iosifa (Pinegin 1932, 1935), and that for the whole Arctic of  $82^{\circ}30'N$  reached by *Roosevelt* in 1908 (Peary 1910) to the north of Ellesmere Island (Chernenko 1962, 1963). Still there was no sign of ice or even of an ice blink to the north.

Nonetheless, certain of the expedition members, and even Ushakov himself, began to doubt the wisdom of pushing too far north in this wedge of open water, which had evidently been driven north into the edge of the Arctic pack by the recent southerly gales. Captain Nikolayev, however, was adamant, and *Sadko* therefore continued northwards until she reached the edge of the close pack on the morning of 13 September at  $82^{\circ}41'6''N$ ,  $87^{\circ}04'E$  (Chernenko 1963; Karelin 1953; Zubov 1936; Yevgenov 1935; Belov 1969). A sounding taken at this point indicated a depth of 2,365 m. *Sadko* was in the Central Arctic Basin.

The well-oiled machinery of a full oceanographic station was quickly set into motion, the ninety-ninth of the expedition. Over the nine hours it lasted, a unique set of data and samples were obtained pertaining to the water, the fauna and the sea bed. One significant discovery was the presence of a layer of warm Atlantic water ( $+2.6^{\circ}C$ ) extending from 150 m to 750 m beneath a cold surface layer ( $0^{\circ}C$ ) 105 m in depth (Balakshin 1935; Zubov 1936).

By the time this historic station was completed, pancake ice was beginning to form on the smooth surface of the sea; losing no time, Nikolayev set a southerly course back to more hospitable latitudes. *Sadko* now steamed south along the eastern edge of the Sadko Bank, crossed it midway between Ostrov Vize and Ostrov Ushakova, then back north along its western side to latitude  $81^{\circ}40'N$  where ice again blocked her progress (Yevgenov 1935; Belov 1969). From regular stations and soundings, as much as possible was determined about this submarine ridge and its overlying waters (Zubov 1936). After a final swing westward to Ostrov Greyem Bell, which she reached on 16 September (Belov 1969), and then back eastward almost to Ostrov Vize, *Sadko* finally headed south. After calling at Amderma she steamed through Yugorskiy Shar, and on 28 September returned to Arkhangel'sk (Chernenko 1963; Karelin 1953; Zubov 1936; Yevgenov 1935).

In numerical terms alone *Sadko's* achievements were impressive. In 85 days she had steamed 12,000 km, 6,000 km of that course lying north of the eightieth parallel (Chernenko 1962). Her scientists had occupied 107 oceanographic stations and 51 gravity stations, sounded 2,500 depths, measured 13 magnetic points and released 21 radiosondes. A total of 227 sea-bed samples had been obtained from 110 stations from depths of up to 3,200 m in the Greenland Sea (Yermolayev 1935). The meteorologists had made 280 observations, of which 263 had been transmitted to the mainland (Belov 1969). The expedition had also discovered a new island, added considerably to the evidence that "Gillis Land" did not exist, determined the submarine topography of the northern part of the Kara Sea (Belov 1969), occupied the first modern oceanographic station in the Central Arctic Basin, and established a new record high latitude for a freely navigating vessel. Most important of all, the meteorological and ice data collected had proved invaluable in helping to forecast conditions along the Northern Sea Route (Chernenko 1963; Karelin 1953; Yevgenov 1935). The data were of particular importance in that two ships, *Vantsetti* and *Iskra*, were attempting the first traverse of the Northern Sea Route by laden freighters that season (Gakkel' 1936; Belov 1969). Altogether it was an impressive record of achievements for a vessel originally designed for service in the Cabot Strait.

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