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THE
MARINE OBSERVER

A Quarterly Journal of Maritime Meteorology
prepared by the Marine Branch of the
Meteorological Office

Vol. XVII

1947

M.O. 489 AIR MINISTRY

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EDITORIAL

The master of a merchant ship has, since Noah first put to sea in his ark, been a man of very great responsibilities. Once clear of his home port his name aboard the ship is law—the safety of the ship, her crew and passengers and cargo are in his hands. He must, of necessity, combine the qualities of business man, lawyer, doctor, diplomat, and above all, he must be a seaman. Science has done much to assist him in carrying out his task in the provision of power-driven ships, radio and navigational aids, but there comes a time, even in the largest and most modern ship, fitted with every conceivable scientific improvement, when the master's personal skill as a seaman will be called to account. And in this modern, competitive age, when the value of shipping not only nationally but internationally is greater than ever before, it is more than ever necessary that the ship master should not be found wanting. It is his duty to his country, to his owners, to his ship and those who sail in her, as well as to himself, to be proficient in every branch of his profession. As the master so the ship's officers—for the officer of the watch holds the safety of the ship in trust for the master. And the junior officer of today is the master of to-morrow.

Every ship's officer aspires to be an efficient seaman—a sailorman—but the attributes are many and not easy to attain, and many of them are only acquired in the hard school of experience.

One of the essentials to the efficient seaman is that he should respect the elements in which he sails and on which he is dependent for his livelihood, for the sea is a wild, unpredictable and fickle mistress who suffers not fools gladly, and the man who courts her without respect will surely be paid out for his temerity. A study of the monthly shipping casualty lists published by Lloyds List will show that even in this age of large modern steel ships of considerable size and power, a surprisingly large number of marine casualties are directly due to the weather and its effects, and it is certain that many others (e.g. groundings and collisions in fog), are indirectly due to the same cause. In peace-time it is probably true that apart from fire and explosion most of the perils of the sea are directly or indirectly caused by the weather or its effect upon the sea, and it is for this reason essential that the seaman, as the farmer, should be weather-wise. A knowledge of the weather, ocean currents, winds and tides is just as valuable now as it was in the days of the sailing ship, in fact, it may be more important, for with the provision of scientific aids to navigation coupled with the up-to-date meteorological information and frequent weather forecasts which are now available to the seaman, more is expected of him. But it must always be borne in mind that radar, radio, echo-sounding and the like are merely aids to navigation, and that meteorological information is of little practical value unless it is used intelligently and with a discreet and seamanlike appreciation of its limitations. For example, when sailing from an East Coast port in a light ship, a master would rightly hesitate to sail with warning of an easterly gale in force; a tug towing a dredger round the coast would be wise to seek a reasonably assured favourable forecast before sailing—but he probably would disregard warnings of fog.

It is only by taking an intelligent and objective interest in these matters, combined with a little of that elusive " sea sense " that the true sailorman is created. Incidentally, one hears a measure of nonsense talked at times about that "sea sense"—strange stories of trawlermen and coasting masters who can smell their way around the coast with nothing but their instinct to guide them and no need for such trivialities as navigational aids. But once again, a study of the shipping casualties and of the cases heard in the Admiralty Courts (coupled so strangely with Divorce proceedings) shows how fatal it can be to rely on " sea sense " alone and how the advice of never neglecting the famous three " L's " (log, lead and lookout), or any other seamanlike precautions, is right.

I am writing this aboard that grand old ship *Aquitania* on my way across the Atlantic to attend an International Meteorological Conference at Toronto. A credit to British shipbuilding, built in 1914, the *Aquitania* appears to be in excellent condition and at a steady 23½ knots almost without vibration. It has been pleasant to talk to the ship's officers and to meet at least one war-time shipmate, and to hear their opinions as to marine meteorology in general, and the taking of observations at sea, in particular. I always approach this subject with some deference, feeling that perhaps we sometimes tend to ask too much in the way of observations from voluntary observers at sea—but I find that most officers with whom I discuss these matters display a really keen interest in meteorology. And they realise, in view of the wide expanse of ocean, how important ships, observations are to the meteorologist and that the meteorologist is doing his best to provide an efficient service for seamen the world over.

It is a pity everybody cannot spend at least a few years of their lives at sea ; if this could come about there would be far less international complications, for seamen, no matter their nationality, can always co-operate and understand one another—the language of the sea is universal.

I will say more about the Toronto conference of the International Meteorological Organisation in a later issue. For the present, suffice to say that it is the first big international conference of that body since 1939, and among the items to be discussed will be (1) a universal world-wide code for meteorological reports to and from ships, shore and aircraft ; (2) a universal scheme for forecasts, analyses, gale warnings, etc. ; (3) a scheme for dividing the oceans into numbered 5° squares on a world-wide basis for forecasting purposes ; (4) general improvements in instruments and methods of observation.

It is interesting and pleasing to reflect, in this generally rather disagreeable world, that very considerable international co-operation has been attained as far as meteorology is concerned. The reason probably is that the meteorologist as a scientist is like the seaman, international in his outlook, working to the best of his ability for the benefit of mankind in general.

By this time (4th August) the *Weather Observer*, the first of the British Ocean Weather Ships, will be on her way out to take up her station at position 53° 50'N., 18° 40'W., for the first time. Many of our readers will have seen accounts in the press of the re-naming ceremony, which was performed by Mr. Philip Noel-Baker, the Secretary of State for Air, in London Dock on 31st July. Formerly the Flower-class corvette *Marguerite*, she is commanded by Captain N. F. Israel, who as a Lieutenant Commander, R.N.R., during the recent war, earned a D.S.C. and two bars in command of similar types of vessels.

The three other ships, *Weather Recorder* ex *Genista*, *Weather Explorer* ex

Thyme, and *Weather Watcher* ex *Snowflake*, which will make up the total necessary to man the two British Ocean Weather Stations, are expected to be ready for sea at approximately monthly intervals. They are being fitted up at Devonport and Rosyth.

It is hoped that the presence of these ships in the Atlantic, combined with the Ocean Weather Ships being provided by other nations, will assist in providing somewhat greater accuracy in forecasting, and as a long-term policy that the information they provide will enable considerable progress to be made in our knowledge of the physics of the atmosphere over the oceans. The upper air observations—to a height of about 45,000 ft.—will at least be unique, for such observations have previously been unobtainable at sea.

Life will be tough for those aboard these ships, but as ex-naval corvettes they were more or less built for the job, and although their motion in heavy weather will be violent, there is no doubt as to their sea-keeping qualities. May good fortune attend those who sail in them—pioneers of this new Ocean Weather Service.

Merchant ships, able to transmit on 600 metres only, will be able to pass weather messages to the United Kingdom through these Ocean Weather Ships.

In our last number it was suggested that a brief account of the activities of the Marine Branch of the Meteorological Office during the 1939–1945 war, might be of interest to readers.

Owing to security no meteorological observations were made in merchant ships. The work of the branch was, therefore, centred upon the extraction of data from past records sent in by merchant ships. In this work the Hollerith statistical machines proved to be indispensible—in fact, without their use the task would have been wellnigh impossible. Roughly 6,000,000 observations were extracted, analysed as necessary, and incorporated in atlases. The arrangement of the atlases was agreed upon between the Meteorological Office and the Naval Meteorological Branch (Admiralty) and the following were compiled :—

Monthly Meteorological Charts of the Atlantic Ocean

Monthly Meteorological Charts of the Greenland and Barents Seas

Monthly Meteorological Charts of the Western Pacific Ocean

Monthly Meteorological Charts of the Eastern Pacific Ocean

Monthly Meteorological Charts of the Indian Ocean

Monthly Sea Surface Temperatures and Surface Current Circulation of Japan Sea and Adjacent Waters

Monthly Sea Surface Temperatures of Australian and New Zealand Waters.

It can be safely claimed that these are probably the most comprehensive atlases of the climatology of the oceans in existence. It is undoubtedly true that the subject-matter of these atlases proved of considerable value to the meteorological services of the allies during the war, particularly in view of the almost complete absence at that time of actual observations from ships at sea.

The Marine Branch worked in close harmony with the Naval Meteorological Service throughout the war, and in addition to the climatological atlases, produced and improved the layout of atlases of surface currents over the oceans and atlases of ice conditions in the Northern Hemisphere. Many special investigations of various types were also made at the request of the Services.

The following current and ice atlases were compiled:—

Quarterly Surface Current Charts of the Western North Pacific Ocean

Quarterly Surface Current Charts of the Atlantic Ocean

Monthly Ice Charts of the Arctic Seas

Monthly Ice Charts of the Western North Atlantic Ocean

Thus the observations which voluntary observers in merchant ships have so painstakingly made since 1854 have been utilised not only for the benefit of seamen both naval and mercantile, but also by the scientists for the welfare of the whole community.

Marine Superintendent.

OCTOBER, NOVEMBER AND DECEMBER

It is hoped that these pages will be filled each quarter with a selection of the contributions of Mariners in manuscript, or remarks from the Logs and Records of regular Marine Observers. Photographs or sketches illustrating observed phenomena are particularly desirable.

Responsibility for statements rests with the Contributor.

LOW BAROMETER READING

North Atlantic Ocean

The following is an extract from the Meteorological Record of M.V. *Chinese Prince*. Captain F. S. Thornton, O.B.E. Hull to Sydney. Observer, Mr. M. E. Musson, Chief Officer.

Year 1945				Ship's Position, Course and Speed				Wind at time of observation		Barometer				
Month	Day of Month	Day of Week	Greenwich Mean Time of Observat'n Hour	Latitude	Longitude	True Course	Average Speed in Knots during last 3 hours	Direction True	Force 0-12	Uncorrected Reading	Att. Ther.	True Atmospheric Pressure at Sea Level	Characteristic of Tendency during previous 3 hours	Amount of change in previous 3 hours
Dec.	18	Tues.	0	58.5	11.2	040	Hove	to ENE	10	958.2	283	961.4	Steady	-
			6	58.5	11.2	045	Hove	to NE	10	938.2	283	941.3	Falling	-
			12	59.4	10.6	253	10	ESE	9	939.1	286	942	Steady	-
			18	59.0	12.7	253	10	E'S	9	932.1	284	935	Falling	-
Dec.	19	Wed.	0	59.0	13.6	253	10	ES	9	924.1	284	928	Falling	-
			6	59.0	16.7	253	7	WSW	8	932.8	284	936	Rising	-
			12	58.8	18.0	242	5	W	9	938.8	284	942	Rising	-
-			18	58.6	19.0	242	5	SW'W	9	942	285	945	Rising	-

The Master of the vessel, Captain F. S. Thornton, O.B.E., has written as follows :—

At the time of our reports I was in ballast and assure you we certainly did get a dusting, quite apart from the marked liveliness of the vessel. As a point of interest, at one period during the height of a strong NNE gale on 17th December, I was steaming with the sea about 6 points on the starboard bow with starboard engine stopped and full ahead port engine (lee engine) with the helm hard to starboard in an endeavour to head her more into the sea, as she was rolling so violently as to cut out the engines too frequently for my liking. This I continued to try for 12 hours, but she would not look at it, and I then turned tail and ran with the sea until it abated sufficiently to enable me to resume my course. So the merry game went on all the passage, " heave to " then " run " with it to avoid pounding too heavily as the direction of the gales changed. Finally I hove to off Cape Race on Christmas night to allow the passengers respite to enjoy (?) their Christmas dinner. I must say they were grand and accepted things very calmly. The Log entries make most interesting reading and I consider myself most fortunate to be able on arrival at Sydney C.B. to report " no apparent damage."

The barometer reading of 928 mb. (27·40 in.) recorded at the standard observing hour was *not* the lowest. An hour after the above recording I had a reading of 27·18 in. (both barometers pumping wildly). At that time the sea seemed to ease with no breaking water, the wind was ESE force 7/8, then within about 20 minutes it eased down to about force 4 and swung round to S and quickly blew to force 8, eased 2 hours later to 5, then hauled to SW × W, force 6. An hour later the wind was WSW, force 9, and 4 hours later again was blowing a full SW gale for another 12 hours. The glass, after the lowest reading (as above), then rose steadily for the next 36 hours until it reached 29·12 in., when it commenced to fall for another easterly gale (21st December).

Note.—The observation of 920·4 mb. (27·18 in.) at 0100 G.M.T. is the lowest barometric pressure yet recorded at sea in other than a tropical revolving storm. In fact, there are few verified lower pressures yet recorded at sea in such storms.

Previous lowest pressures reported are as follows :—

5th February, 1870. R.M.S. *Tarifa* in Latitude 51° 03′N., Longitude 23° 59′W. 925·5 mb. (27·33 in.).

4th December, 1929. U.S.A. S.S. *Westpool* in Latitude 50° 47′N. Longitude 16° 38′W. 929 mb. (27·46 in.).

4th December, 1929. U.S.A. S.S. *Balsam* in Latitude 52° 07′N., Longitude 18° 41′W. 927 mb. (27·40 in.).

It is interesting to note that all these low values were recorded in the Eastern North Atlantic.

CURRENT RIP AND DRIFTING LOGS

Australian Waters

The following letter has been received from Captain David McLeish, Master of the S.S. *Wahine.*

While on a voyage from Auckland, New Zealand, to Tulagi, Solomon Islands, and in Latitude 15° 43′S., Longitude 160° 23′E., at 2200 G.M.T. on 9th October, 1945, I encountered a current rip, remarkable in as much as it stretched in a straight line 030° and 210° from horizon as far as the eye could see and was not more than a quarter of a mile in width. The weather at the time was fine, wind SE force 4/5, sea slight to moderate and no swell.

The sea temperature, which for some time previous had been rising steadily at ½° to 1° F. each 4 hours, fell in the 4 hours prior to encountering this rip from 79° to 76° F. and in the 4 hours following rose from 76° to 80° and then again settled down to its former gradual rise. No set was experienced about this time.

Unfortunately my vessel is not fitted with an echometer so I could not ascertain the depth: from a distance this rip had the appearance of a moderate sea breaking on shoal water, but, as I passed through it, I am certain there is no shoal water there.

On my return voyage from Tulagi to Auckland and when in Latitude 12° 57′S., Longitude 159° 28′E., at 0200 G.M.T. on 15th October, 1945, some objects were observed in the water. On altering course and investigating, I found them to be 3 logs intermingled with a quantity of small drift wood. The largest log was about 15 ft. in length and about 12 to 18 in. in diameter, and appeared to be a twisted tree trunk, and although much water worn, was free of marine growth. The interesting and peculiar thing about this is that the driftwood was clustered together and covered an area of not more than 20 yds. square. No set had been experienced prior to reaching this position but, during the following 24 hours vessel was set 320° 12 miles.

Note.—Records of current are rather scarce in the region of observation of this current rip. There is possibly a branching of current in this region in October, part flowing westward towards Torres Strait and part flowing south-westward to join the East Australian Coast Current. It is probable, however, that this rip, and the majority of those observed in the open ocean, are produced by transitory local convergences or divergences of masses of water, the result of current variation and eddying under changing local wind conditions. The drop in sea temperature recorded on this occasion appears to indicate a divergence of the surface water, with consequent upwelling of cooler water from below to take its place.

TRADE WINDS

Indian Ocean

The following is an extract from the Meteorological Record of S.S. *Mulbera.* Captain T. J. Murphy. Colombo to Fremantle. Observer, Mr. T. A. Robinson, 2nd Officer.

6th–14th December, 1946. Strong SE trade winds, average force 5, extended from Latitude 5° S. to 31° S., Longitude 90° E. to 114° E. Although by no means a new observation, it is interesting to confirm that they reached their daily peak velocity, frequently force 6, at 0300 A.T.S. accompanied by a corresponding increase in height of sea, and most noticeably the swell, often causing considerable movement and labouring in contrast to the steady steaming during the day and first half of the night.

ARCHED SQUALL

Indian Ocean

The following is an extract from the Meteorological Record of S.S. *Clan Macrae.* Captain A. G. Macpherson. Liverpool to South Africa and Australia. Observer, Mr. G. S. Gann, 3rd Officer.

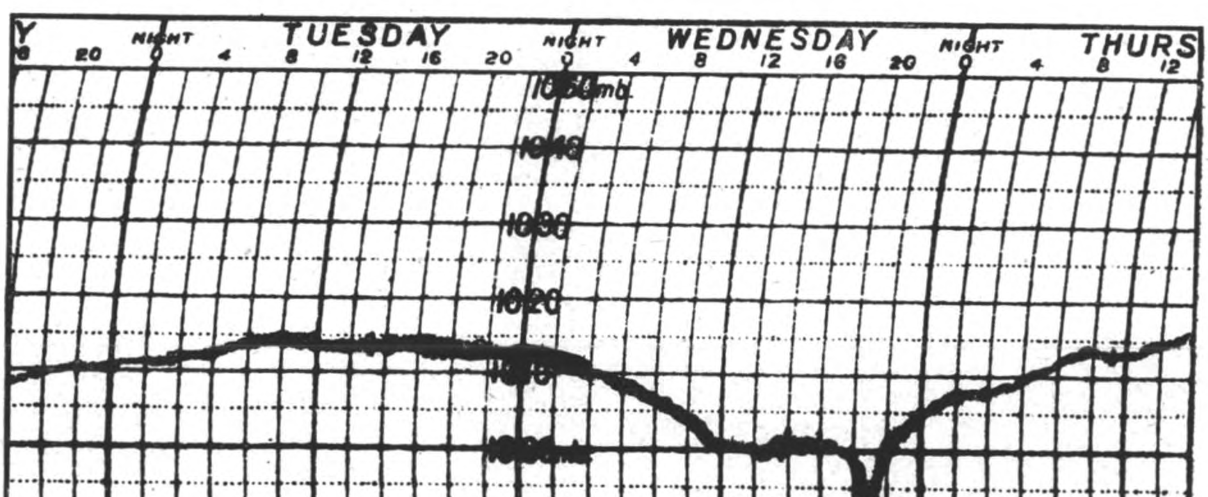
2nd October, 1946, 1900 G.M.T. A well-defined arched squall of low cumulonimbus clouds was observed 2 points on the starboard bow. No wind, smooth sea, air temperature 72° F. On approaching the squall the temperature dropped to 67°, wet bulb 65°, and the wind became strong, from SSE. By 1900 G.M.T. the whole sky was overcast with cumulonimbus cloud and the barometer had fallen 1·5 mb. The depression of wet bulb was then 0·5° and heavy rain set in with moderate to poor visibility, lasting for 12 minutes. The barometer then started to rise, wind backed to E and moderated and the depression of wet bulb was 2°. The sky was overcast with fractonimbus cloud, clearing slowly and leaving a poorly-defined arched squall astern. By 2130 G.M.T. the wind was calm, air temperature 68°, wet bulb 65°, and sky partly cloudy with cumulus.

Position of Ship : Latitude 28° 12′S., Longitude 51° 45′E.

LINE SQUALLS

Mediterranean Sea

The following is an extract from the Meteorological Record of S.S. *Clan Chattan.* Captain H. C. Simpson. Birkenhead to West Coast of India. Observer, Mr. J. W. Ward, 2nd Officer.



8th October, 1946, 1200 to 2400 G.M.T. Weather conditions at 1200: wind SE force 4, barometer 999 mb. falling rapidly, sky 7/10 fractocumulus cloud. Also at 1200, M.V. *Herefordshire* in position 36° 00′N., 00° 36′W., reported wind E force 4, barometer 998 mb. Between 1300 and 1400 the wind shifted to SSW force 4 and the sky remained the same as at noon. At 1600 wind SW with fierce squalls of force 8, barometer 998 mb. At 1700 wind force 7/8, barometer steady. At 2000 to 2030 wind veered to NW force 8/10 in squalls, barometer fell to 987 mb., sky remained the same as before. By midnight the wind had dropped to force 5/6, the barometer had risen to 1006 mb. and the sky had cleared. From then on the weather steadily improved and the wind moderated.

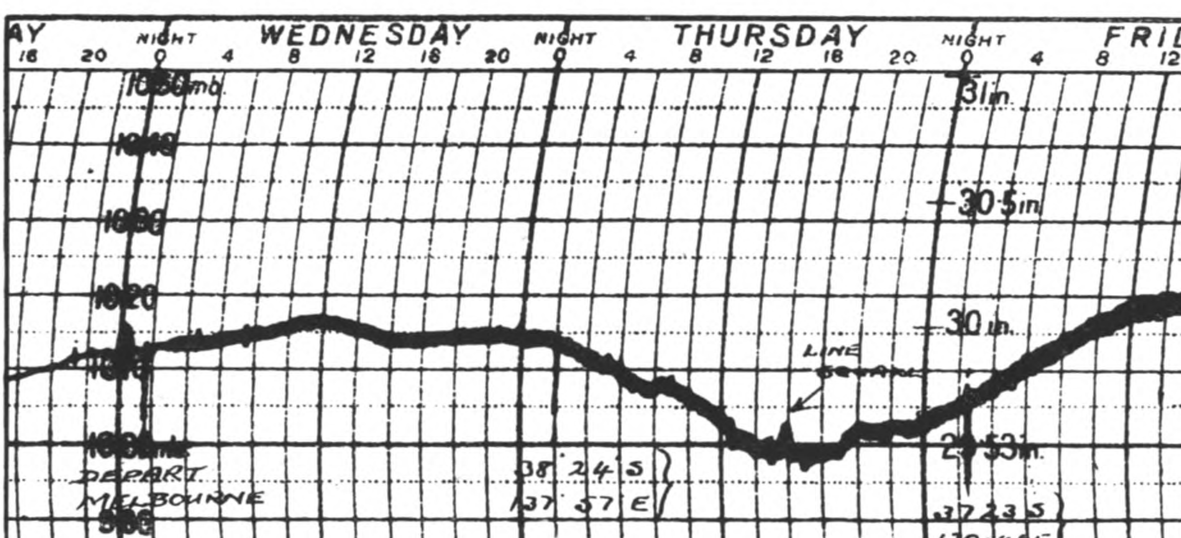
Position of Ship at 1200 G.M.T.: Latitude 37° 04′N., Longitude 02° 07′E.

South Australian Waters

The following is an extract from the Meteorological Record of M.V. *Telemachus*. Captain J. F. Webster. Melbourne to Colombo. Observer, Mr. J. F. C. Dowie.

21st November, 1946, 1700 G.M.T. A line squall was experienced. There was a roll of cumulus cloud from N to S. The wind moderated before the cloud passed, later backed to NW, freshened before it veered rapidly to SW and moderated to a gentle breeze. Lightning was frequent before the squall passed and it was accompanied by intermittent light rain. The barometer rose sharply and then returned to its previous reading.

Approximate position of Ship: Latitude 37° 47′S., Longitude 133° 31′E.



ABNORMAL REFRACTION

West Coast of Australia

The following is an extract from the Meteorological Record of S.S. *Otranto*. Captain N. Savage, C.B.E. London to Australia. Observer, Mr. D. Kinloch, 3rd Officer.

25th December, 1946, 1500 G.M.T. approximately. Rottnest High Light, Fremantle, whose charted range is given as 25 miles, was sighted due to excessive refraction at 63 miles bearing 121° (True).

Weather conditions as follows : wind, light airs and calms. Temperature, dry bulb 73°F, wet bulb 67°, sea surface 70°. Corrected barometer 1004·9 mb.

ST. ELMO'S FIRE

Coast of New Brunswick

The following is an extract from the Meteorological Record of M.V. *Beaverdell*. Captain R. V. Burns. London to St. John, N.B. Observer, Mr. R. Gillett, 4th Officer.

22nd December, 1946, 0045 G.M.T. A ball of St. Elmo's Fire, approximately 1 ft. in diameter, glowed at the port end of the signal yard for about 5 to 10 minutes. Weather at the time: overcast with frequent heavy rain squalls.

Approximate position of Ship : Latitude 43° 24'N., Longitude 63° 05'W.

LUNAR RAINBOW

Red Sea

The following is an extract from the Meteorological Record of S.S. *Mandasor*. Captain L. E. Jeans. Suez to Aden. Observer, Mr. D. J. Evans, 2nd Officer.

9th November, 1946, 0100 G.M.T. When 16 miles SSE of Daedalus Reef a line squall cloud stretched from E to W horizon ahead. The sea was calm and smooth. At 0105 a squall broke with wind SE force 5, rapidly increasing to force 7 and with moderately heavy rain. The barometer 1010·0 mb. dropped 0·2 mb. in 2 minutes, the thermometer 77·5° F. dropped 4·5°. At 0415 an unusually bright lunar rainbow appeared bearing from 062° to 122°, each end touching the horizon in a perfect arc of altitude 15°. The colours were of unusual brilliance and clearness, red, orange, yellow, green, blue and violet. The green was brightest with orange and violet very distinct. The moon was full bearing 272½°.

Approximate position of Ship : Latitude 24° 54'N., Longitude 36° 00'E.

Note.—The statement that lunar rainbows are white and do not show the spectrum colours is still to be met with in books. The above observation disproves this and a number of previous observations from ships recording colour in lunar rainbows has been received. It is probably rare for the bow and the colours to be as bright as in the observation of S.S. *Mandasor*. The whiteness, or pale colouring, of most lunar rainbows is due to the relative faintness of the bow ; the brighter the bow, the stronger, in general, the colour.

AURORA

South Australian Waters

The following is an extract from the Meteorological Record of S.S. *Clan Macaulay*. Captain J. D. Matthews, O.B.E. Beira to Tasmania. Observer, Mr. T. R. Halliday, 2nd Officer.

21st November, 1946, 1200 to 1800 G.M.T. An auroral display was seen over arc of horizon S30°E. to S25°W. Above clouds of altitude 5° there appeared a yellow glow, becoming whitish yellow at about 15° altitude, with occasional streaks like searchlights, and of a slight reddish colour, reaching up to 50° altitude.

Position of Ship : Latitude 43° 08'S. to 43° 12'S., Longitude 116° 33'E. to 118° 40'E.

GIACOBINID METEOR SHOWER

North Atlantic Ocean

The following is an extract from the Meteorological Record of M.V. *Empire Tagralia*. Captain J. Auld. London to Aruba. Observer, Mr. W. Owen, 2nd Officer.

10th October, 1946, 0340 to 0400 G.M.T. 150 meteors of various sizes were sighted. They all commenced visible passage around the Pole Star area and about two-thirds of the total reached the Orion group before fading. Numerous small ones were not counted. Cirrus cloud NW/W/S, remainder of sky very clear.

Position of Ship : Latitude 43° 20′N., Longitude 24° 00′W.

Note.—Observations of this meteor shower were also made by the following ships :

S.S. *Aquitania*, North Atlantic Ocean, Latitude 50° 11′N., Longitude 26° 20′W. At 0060 G.M.T. " numerous meteors observed throughout last 4 hours."

S.S. *Lord Glentoran*, North Atlantic Ocean, between Latitude 54° 49′N., Longitude 42° 17′W. and Latitude 54° 54′N., Longitude 41° 15′W. During the time midnight to 0600 G.M.T. " numerous shooting stars."

S.S. *Moreton Bay*, Mediterranean, in approximate position Latitude 36° 37′N., Longitude 0° 10′E. " at 0430 G.M.T. large formation of meteors appearing from N and travelling due S, at times very brilliant.

The meteors observed by the above ships were part of the Giacobinid meteor shower, which was forecast by astronomers to occur on the night of 9th–10th October, 1946, the expected time of the greatest number of meteors per minute being from 0300 to 0400 G.M.T. on the 10th. The meteors seen were part of the substance of a comet discovered in 1900, and known from the names of its discoverers as Comet Giacobini-Zinner. The main body, or head, of a comet is not a solid object but an assemblage of a very large number of small solid objects, pieces of metallic or stony matter, ranging in size from that of a grain of sand upwards to masses probably weighing many tons.

An ordinary meteor, or " shooting star ", is about the size of a grain of sand, when, as a result of the combined movements of the earth and the meteor in space, one enters the earth's upper atmosphere, it is burnt up and vaporised by friction with the air. The meteor is thus only visible to us in the process of its disintegration. A fairly bright meteor is perhaps about as large as a pea. Occasional ones are very much larger, and part may survive to reach the ground or fall into the sea as a meteorite.

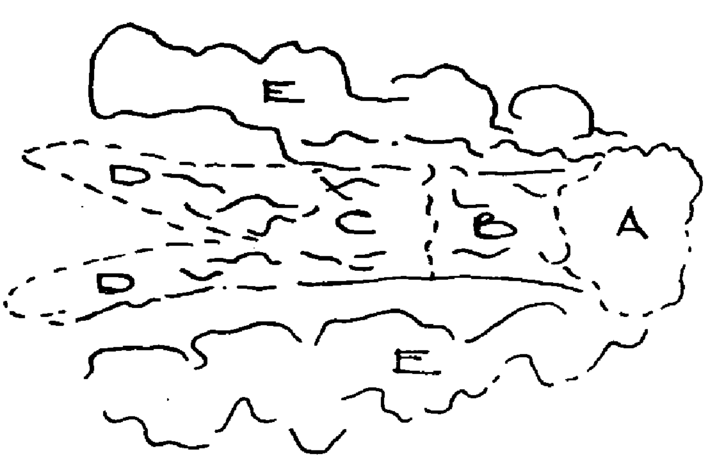
The assemblage of objects forming a comet is spread over a space which may be a few hundred or a few thousand miles in diameter. This assemblage travels round the sun in an elliptical orbit, often very elongated. In course of time some of the smaller objects comprising the comet get spread out along the orbit, at any rate for a considerable distance on either side of the main body. Should the earth's orbit intersect the orbit of the comet at a point not too far distant from the place of the comet at the time, a more or less numerous shower of meteors will be observed as they enter the earth's atmosphere. Their observed tracks in the sky will, if produced backwards, converge in one point, or small area, of the sky. A meteor shower giving as many as hundreds or thousands of meteors per hour is a rare event.

Between the date of the discovery of Comet Giacobini-Zinner and 1926, the orbits of the earth and the comet did not intersect. Comets' orbits are, however, liable to change of shape and position under the gravitational attraction of one of the planets, if the comet passes sufficiently near it, the planet being a much more massive body than the comet. This occurred in the present case and the orbits intersected in 1926, when a small meteor shower was observed, the comet being a long way from the point of intersection. The period of this comet's revolution in its orbit is 6·6 years. In 1933, at the next time of intersection, a very prolific meteor shower was seen, the earth and comet being much nearer than in 1926. In 1939 only a small shower occurred. In 1946 it was anticipated that the shower would be even finer than in 1933, as the earth would be nearer the main mass of the comet, but for some unknown reason this was not the case, and the shower, though a fine one, gave many less meteors than in 1933. Visual observation was scanty in the British Isles owing to overcast skies, but the new method of observing meteors by radar was brought into use. This confirmed the observation made in other countries and by ships that the meteors were relatively infrequent.

METEORS

Caribbean Sea

The following is an extract from the Meteorological Record of M.V. *Waipawa*. Captain W. G. West. Wellington, New Zealand, to Liverpool *via* Panama. Observer, Mr. D. MacCallum, 3rd Officer.



At A : light intensity greater than Venus.
At B : variable light intensity.
At C : area of fiery red.
At D : trails of flame and spark.
At E : luminous vapours.

1st October, 1946, 0223 G.M.T. Observed a remarkable meteor. It first appeared in the vicinity of Draco at about 20° altitude, moving with the speed of fast cloud in a direct line almost horizontally towards the Pole Star. The fore part was brighter than Venus (no reflection or glare on water was noticed however) and this brightest area had an apparent size twice that of Venus. The middle section, a larger area of cylindrical shape, was of varying light intensity and the "tail", streaky and broken, was dull red. The whole had an apparent length of 2 sun diameters. After about 6 seconds it had moved to an area 5° approximately beyond Polaris, where at altitude 15° it appeared to disintegrate, with "sparks" falling from it. The latter disappeared at altitude 12°. The period of observation was 9 seconds and the sky was cloudless.

Position of Ship : Latitude 11° 48'N., Longitude 73° 30'W.

Indian Ocean

The following is an extract from the Meteorological Record of M.V. *Worcestershire*. Captain P. H. Potter. Liverpool to Bombay. Observer, Mr. J. A. Roberts, 3rd Officer.

14th December, 1945, 1950 A.S.T. Meteor observed bursting into view bearing 196°, altitude 16°, travelling apparently west, increasing altitude in a slow curve to 18° and descending again to 16°, when it disappeared bearing 186°. Appearance: orange, tadpole-shaped, about 8 minutes of arc in diameter leaving a long white trail.

Position of Ship: Latitude 18° 27′N., Longitude 71° 01′E.

Mediterranean Sea

The following is an extract from the Meteorological Record of S.S. *Southern Collins*. Captain D. Hunter. Abadan to United Kingdom. Observer, Mr. R. L. Wood, 2nd Officer.

25th October, 1946, 0125 G.M.T. An extremely bright meteor was observed in a dark sky to the north of Canis Major. It travelled a very short distance, leaving a bright nebulous trail, then abruptly disappeared. A period of 1 min. 15 secs. elapsed before all trace of this phenomenon became invisible to the naked eye.

Position of Ship: Latitude 33° N., Longitude 28°E.

North Atlantic Ocean

The following is an extract from the Meteorological Record of M.V. *Empire Tagralia*. Captain J. Auld. London to Aruba. Observer, Mr. H. Thompson, Chief Officer.

18th October, 1946, 0820 G.M.T. A large meteor passed between the moon and Saturn travelling towards Regulus, bursting with a vivid green flash lighting up the whole sky. The trail took about 12 seconds to die down, then one could see the dust trail in the form of a snake which took about 10 seconds to disappear.

Position of Ship: Latitude 26° 00′N., Longitude 56° 00′W.

The following is an extract from the Meteorological Record of S.S. *Tactician*. Captain A. Robertson. New Orleans to Liverpool. Observer, Mr. D. Bloom, 3rd Officer.

14th December, 1946, 0036 G.M.T. A remarkable meteor was observed through a gap in cumulus cloud at an approximate altitude of 15°, to the southward of Procyon. There was no apparent flight, just a vivid white flash which illuminated the sea and lasted for a period of 2 to 3 seconds. During the period of illumination, 2 small meteors were observed which appeared to have been thrown off to the westward by the main body. The flash was much brighter than any star or planet and much larger. Before and after this incident, abnormal quantities of meteors were seen.

Position of Ship: Latitude 36° 15′N., Longitude 32° 34′W. Course 073°. Speed 10·5 knots.

Note.—The abnormal quantities of meteors seen on this night were probably from the Geminid shower which occurs each year and is at its maximum on the nights of 12th–13th and 13th–14th of December. The hourly number of such meteors, which have their radiant point in the constellation of Gemini, may be as many as 60 on these nights, an average of 1 per minute.

North Atlantic Ocean and Mediterranean Sea

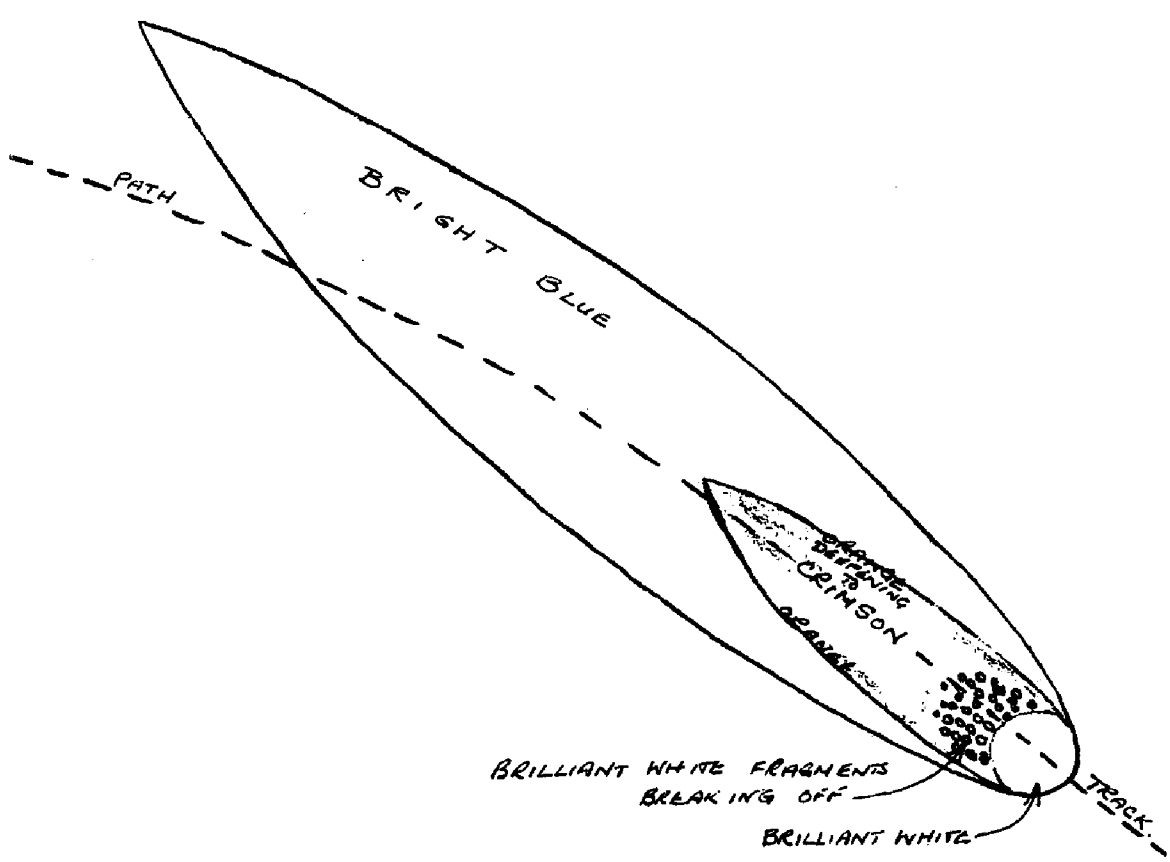
The following are extracts from the Meteorological Record of M.V. *Empire MacCabe.* Captain H. I. McMichael. Curaçao to Bari. Observer, Mr. C. D. Ayres.

6th December, 1945, 0323 G.M.T. A meteor appeared from behind a cloud bearing 200°, altitude 32°, travelling quickly in a westerly direction. When bearing 210°, altitude 22°, there was a brilliant flash of light, leaving a trail of stars of about 7° which disappeared in 5 or 6 seconds. From the time of sighting, the whole thing was over in about 15 seconds. When first seen the magnitude was about — 2. The sky at the time was clear with 4/10ths cumulus; wind SSE force 5; barometer 30·14 in. steady; air temperature 69° F., wet bulb 67° F.; distant lightning.

Position of Ship: Latitude 30° 40'N., Longitude 28° 14'W.

11th December, 1945, 0339 G.M.T. A meteor appeared bearing approximately 164°, altitude 45°. When first seen the magnitude was about — 2 and it increased in brilliancy, until when bearing 150°, altitude 10°, there was a brilliant green flash leaving practically no trail. The time the meteor was in sight was 5 seconds. The sky was clear with 2/10ths cumulus; wind E × N force 4; barometer 30·05 in. rising; air temperature 57° F., wet bulb 49° F.

Position of Ship: Latitude 36° 20'N., Longitude 03° 01'W.



(See under " Meteor, North-east Coast, South America ")

North-east Coast, South America

The following is an extract from the Meteorological Record of S.S. *Thistlemuir*. Captain G. F. Dobson. New York to Pernambuco. Observer, Mr. J. Andrews, 3rd Officer.

12th December, 1946, 2222 G.M.T. A meteor appeared approximately 5° west of Deneb Kaitos (β Ceti). It travelled in a low curve, gaining in brilliance until it disappeared behind small cumulus clouds low down on the horizon at approximately 9° SSE of ϵ Cygni, and the duration of flight was about 1½ seconds. The whole phenomenon was well defined, comparable to a bunsen flame and of such brilliance as to illuminate the whole of the vessel and the horizon. No other meteors of any brilliance were seen again that night.

Position of Ship : Latitude 04° 26′S., Longitude 34° 25′W.

West African Waters

The following is an extract from the Meteorological Record of M.V. *King Robert*. Captain G. Craze. Dakar to Port Adelaide. Observer, Mr. W. Keith, Chief Officer.

21st December, 1946, 2215 G.M.T. (approximately). A remarkable bright green meteor was observed bearing approximately 112°. It commenced its flight at ϵ Orionis and proceeded in a northerly direction, losing altitude and finally disappearing at an altitude of 10° in a yellow flash of light, which was followed by a muffled report after an interval of 5 seconds. During its flight, which lasted 5 seconds, the whole area from horizon to horizon was lit up by its vivid green light. The weather at the time was cloudy and clear with light variable winds, air temperature 79° F.

Position of Ship : Latitude 12° 22′N., Longitude 17° 42′W. Course 186°.

Note.—This meteor must have come very near the sea surface before exploding, as the interval of 5 seconds between flash and report indicates a height at the time of the explosion of about 1 mile. The average meteor's apparent flight ends at a much greater height and the noise of the explosion, if one occurs, is rarely heard.

INSTITUTE OF NAVIGATION

It has been announced by the Institute of Navigation that the Astronomer Royal (Sir Harold Spencer Jones) has accepted nomination as President of the Institute. Air-Chief Marshal Sir John Slessor and Sir Robert Watson Watt have accepted nomination as Vice-Presidents.

PLANKTON

BY J. G. CATTLEY, M.SC.
(FISHERIES LABORATORY, LOWESTOFT)

The sea has always held a fascination and a sense of mystery. We are aware of a number of forms of life, both plant and animal, revealed as the tide recedes on our shores, in rock pools and stranded on the beach, but this is a mere fringe on the edge of the unknown, an unknown which covers over two-thirds of the earth's surface and from which, to heighten our interest, huge quantities of food in the form of fish are caught each year and landed at our ports. How is this vast fish population, which, for instance, yielded over 750,000 tons of wet fish at English and Welsh ports in 1938, able to support itself ?

Land plants extract nutrient salts from the earth and by possessing the power to utilise the air that surrounds them are able to combine the products to build up the tissues of their bodies. On these plants each animal, be it insect, mammal or even man himself, is dependent for food, some directly, some indirectly by feeding on other animals. Small bodies known as chloroplasts in the cells of each plant possess a green pigment which, when light shines on them, enables the plant to absorb carbon dioxide from the air and with the aid of water change it into sugar, starch, cellulose or other carbohydrates. The process taking place in the plant is called photosynthesis —a building up in the presence of light—and the pigment that possesses this power is chlorophyll. From the simple carbohydrates, by chemical combination with the salts extracted by its roots, the plant is able to produce its complex body tissues.

In the sea the amount of light to be found at any depth depends upon the altitude and strength of the sun, on the weather conditions and on the turbidity of the water itself. Much of the light is, moreover, reflected from the surface, for only when the sun is vertically overhead and the sea itself is as calm as glass, can most of the light penetrate the actual surface. That light which does penetrate, however, is rapidly absorbed by the water. Along the coasts, therefore, it is only to a little beyond low-water mark that plants of any size are found rooted in the bottom. This forms but a tiny fringe on the edge of the seas and we must look elsewhere for forms of plant life which must be present to support the animal population.

If we tow a fine-meshed net slowly through the sea for about 10 minutes we shall invariably capture a remarkable collection of creatures, many of which are so small that a microscope is needed to see them. As the water drains away the creatures collect into a paste of a greenish or brown colour. Under the microscope the greenish stuff turns out to be minute plants, the brown, minute animals. It is these creatures which we call " plankton ". We owe the name to Victor Hensen, a Kiel professor, who found it necessary to introduce the term early in the 1880's. Hensen used a more elaborate form of net than the one we used, the form of which is shown in Fig. 1, although in principle it is essentially the same. Now " plankton " is such a useful term that no marine biologist can get on without it. It covers all those living forms, mainly minute or microscopic, that are suspended in the water layers at all depths and drift about passively at the mercy of the tides and currents. It can be collected from the waters of any sea and also from

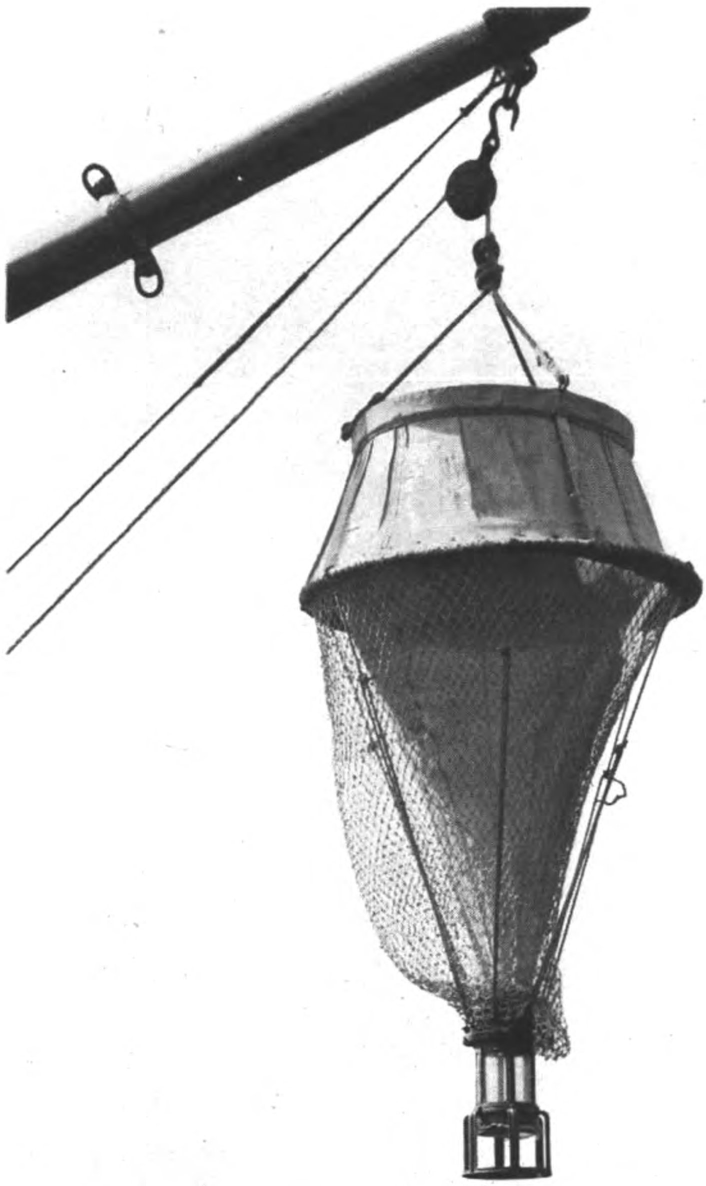


Fig. 1. Hensen's net for catching plankton

fresh water. At times this drifting life is so abundant that it colours the sea for miles around. Such expressions as " red water ", " yellow water ", " green water " are used by fishermen, who by slight differences in the tint of the water, unnoticed by the average landsman, have become expert at deciding where to shoot their drift nets, for they have learnt that the causes of the various tints of the water either favour or prejudice large catches of fish.

Until the advent of the microscope little was known about the creatures of the plankton and nothing of those which consist of a single cell. The first to use the microscope for studying unicellular organisms in the sea was O. F. Müller, a celebrated Danish zoologist, who described one of the most important plants of the plankton in our Northern waters more than a 100 years before Hensen coined the word " plankton ". Müller was succeeded by a brilliant series of scientists who laid the basis for our modern classification of both planktonic plants (or phytoplankton) and planktonic animals (or zooplankton).

Phytoplankton then, constitutes the plants of the sea and in it we have found the plant life whose presence is necessary to, and capable of, supporting the animal population.

Before we consider the multiplicity of forms that are to be found in the plankton we must make brief reference to the great work for which Hensen is justly famous. To this worker credit must be given for instituting the first quantitative estimation of the plankton. Until his time, every worker had been content merely to describe the great variety of life to be found. The questions that Hensen attempted to answer were :—

(1) What quantity of living organisms is present at a given time in the plankton, and (2) how does this material vary from season to season and from year to year ? He constructed nets, a form of which is still in use and has already been referred to and is represented in Fig. 1. These nets were hauled for certain distances through the water, and were supposed to filter the whole column of liquid through which they passed, and to retain all the drifting organisms existing therein. The total amount of these organisms was then measured by determining their volume, and a most careful enumeration was made of the number of individuals belonging to each species. The nets were drawn vertically through the whole zone where plant life is abundant, that is to say, from a depth of 30–50 metres to the surface (the depth to which the sun's rays penetrating the water are of active use to plants) ; and Hensen attempted to utilise the results for measuring the production of life in a column of water whose superficial area is 1 square metre. Later, Hensen found that the net did not filter all the column of water which passed through it and arrived at a coefficient of filtration (taken for general use as 3), thus enabling a true estimate to be obtained of the actual volume filtered. Hensen's method is the one most widely used by all countries engaged on planktonic work at the present time and, for example, is the method in use at the Fisheries Laboratory at Lowestoft, for the English research into the plankton of the southern North Sea.

Let us turn to an examination of the plankton already described as a " paste ". After diluting a small portion with sea water, we place a drop on a slide and examine it under the microscope. At once we become aware that we are viewing a new world as it were, of strange creatures the beauty and variety of which is seldom surpassed by any form found on the land (Fig. 2). Among these forms, plants are not like the plants on land, but consist generally of a single cell only ; nevertheless, they are plants in the true sense of the word because each contains within its cell chlorophyll, responsible for the green coloration. They are, moreover, like any other plant in their food requirements. To live and grow they need first, carbon dioxide. This is always dissolved in sea water in sufficient quantity. Then they need nutrient salts, which are also to be found dissolved in the sea, and finally, sunlight. We shall find that the last two requirements, either or both of which may be in limited supply in the different months of the year, control the outburst of growth or " flowering " of these plants.

The forms we have been considering are known as " diatoms " ; they are so called because they have, surrounding their cell walls, glass-like protective shells composed of two halves—two lid-like structures that fit one into the other, and thus enclose the body of the plant in a box. Some of them indeed, are really very like a plain pill-box, appearing end-on to our view as small circular

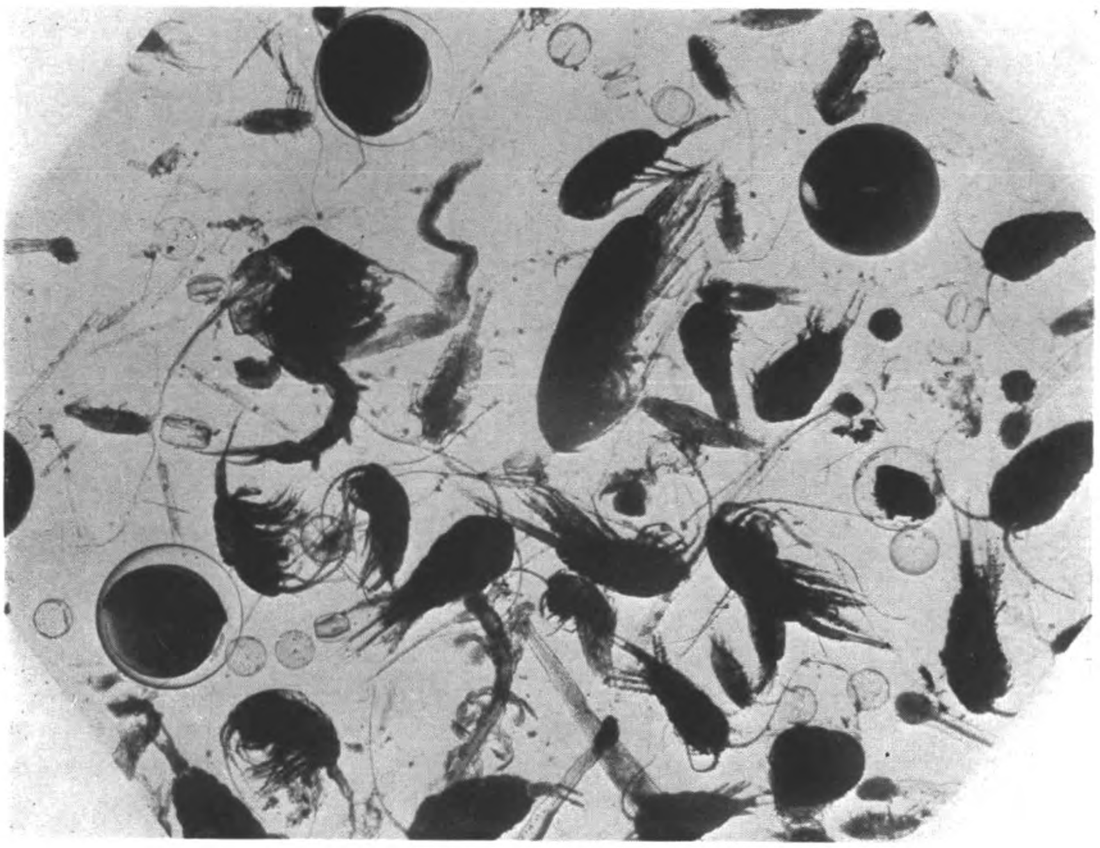


Fig. 2. A mixed sample of zooplankton and phytoplankton

discs. In many, however, the box will be seen to be highly ornamented with fine sculpturing and the body may have a multiplicity of form, in some cases being oblong with little spines or horns projecting from each corner, in others spindle shaped, while yet others may be squeezed in, flattened or pulled out in a number of different ways. Some of the cells may be solitary while others are joined up together in chains of varying lengths, sometimes forming spirals and curves. Now while land plants generally utilise the carbon dioxide of the air in the production of starch, the diatoms often use it to form fat. This will be of importance when we consider the animals, called collectively, " zooplankton."

In addition to the diatoms there are other single-celled organisms of plant life to be seen, called " peridinians ". They are specially remarkable because, besides containing the colouring matter of plants, they possess two fine structures like the lashes of a whip which, by vigorous waving motion, serve to propel the creature through the water. Now we have seen that a true plant derives all its nourishment from gases and dissolved salts, which are absorbed through the cell walls ; it never takes in solid particles of food as an animal does. Many of the peridinians have no coloration, and are able to swallow solid particles of food through a small depression on their cell surface. There are, however, a few which possess colouring matter and also swallow solid particles ; that is to say, they are able to feed like plants, and at the same time utilise solid food particles like animals. On account of this double role, they are a continual source of argument in scientific circles : sometimes the botanists claim them as plants and the zoologists maintain that they are animals, and at other periods of scientific fashion both parties disown them !

So far in our examination we have considered only the plants, but we can see as well a great variety of animal forms. In fact almost every group of the animal kingdom has representatives in the plankton. Even the young of many kinds of fish lead a drifting existence, for a shorter or longer period. Some others of the animals of the plankton are represented only in their young stages, the adults leading a sedentary existence on the sea bottom, while other kinds remain for their whole life drifting at the mercy of the currents. We can call special attention here to one group of shrimp-like creatures known as " copepods ". These are of far the greatest importance in the animal plankton, where they spend the whole of their lives. They are all small, the largest being under $\frac{1}{2}$ in. in length. While there are many species included in the group of copepods, there is one that stands out above

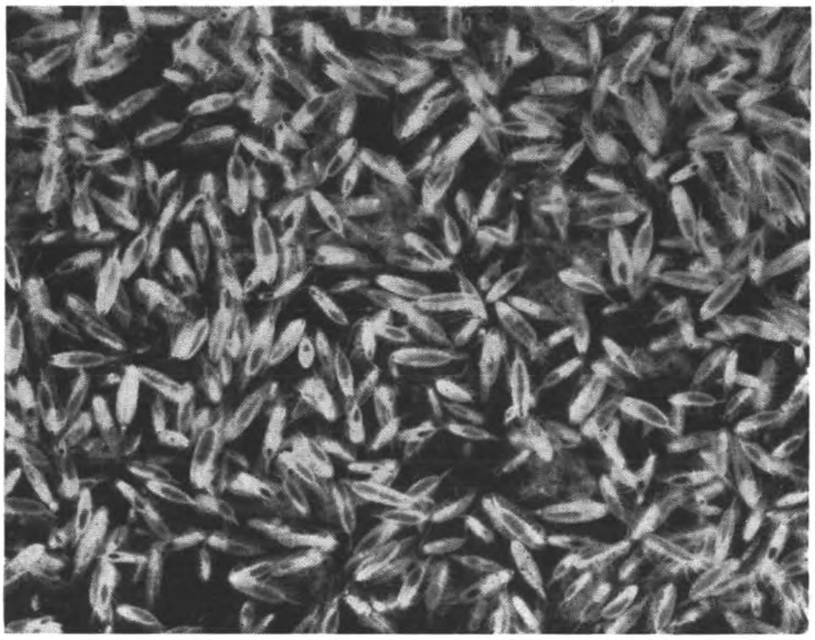


Fig. 3. A sample taken from a shoal of *Calanus finmarchicus*

all others in numbers and importance, for at times it forms the chief food of the herring and it, or its related species in the southern hemisphere, is even sufficiently abundant to aid in building up the enormous bodies of two of the best-known species of whales (the Greenland Whale and the Blue Whale)—for both the herring and these whales live directly on the zooplankton. This copepod has no popular name but its Latin name is *Calanus finmarchicus* (see Fig. 3) : however, for short it is becoming known simply as " Calanus."

Now the importance of plankton will be becoming apparent, but to complete the picture we must realise that the minute plants form the food of the zooplankton. The " food chain ", as it is called, between the diatom on the one hand and the herring or blue whale on the other is short and direct, but usually food chains are more complex than this. In general, the zooplankton is in turn consumed by larger animals and by small fish, some of which are eaten by still larger creatures, including most of the commoner food fishes.

We have mentioned that the diatoms tend to produce fat rather than starch. This fat is passed on to the animals which feed on them and is often apparent in copepods as an oil of a reddish or pinkish colour. It is this oil which is the primary cause of the red coloration of the sea at certain times when calanus occurs in hordes. Its economic importance is so great that it need only be pointed out here, since it is passed on to our food fishes, particularly the herring and pilchard, and is also the main constituent of cod-liver oil.

Apart from other things the blue whale is of interest because it is one of the largest of living creatures, and yet it can find enough plankton to evil on in the nearly frozen seas of the Arctic and Antarctic regions. There is in fact more plankton in the Polar seas than in the tropics. This point has been of great interest to oceanographers and marine biologists and its explanation has called on all the resources of scientific exploration and research.

We have alluded to the fact that phytoplankton, like any other plant, is dependent for growth on carbon dioxide, nutrient salts and sunlight, and that either or both of the last two, being limited in supply in some months, control the " flowering " of this population. This is reminiscent of what appertains on land, for land plants do not grow equally well over the whole surface. At some places there may be sufficient sunlight for them but the soil is unsuitable ; at others the soil is suitable but there is not enough sunshine. It is the same in the sea. Phytoplankton will flourish wherever it finds the right conditions, and these conditions are to be found in the Polar seas. In the high latitudes, north and south, there is an abundant supply of the necessary nutrients, and in the short summers of the Polar latitudes there is an enormous " flowering " of phytoplankton.

In the temperate regions the nutrient salts in the surface water get cut off from the source of supply in the rich bottom layer, because the higher temperatures of the temperate regions lead to the formation of a stable layer of warm water near the surface which does not mix with the lower water. Thus it happens that when the longer, lighter days of the spring come round, there is a " flowering " of the phytoplankton which reaches its maximum at or soon after this time ; but then it uses up all the available salts in the surface water and the plankton dies away. When this happens, however, the individual organisms decompose, and the salts they contain are returned to circulation. As a result, later in the year more salts become available again, and there is often a second " flowering " in the autumn. Another factor which favours this " flowering " in the autumn is the cooling of the surface layer so that it becomes denser and sinking, mixes with the hitherto isolated bottom layers.

The nearer we approach the equator the scarcer becomes the plankton, except in waters influenced by large rivers or upwellings from the bottom. The light penetrates farther into the sea, but other factors are unfavourable. Thus, as there is no winter resting period, growth is continuous, and the essential salts, which are present only in very small quantities in the upper layers of water, are being used up continuously. Consequently, there are not sufficient nutrient salts to support a great population of plankton. It is this lack of phytoplankton that is the cause of the poor fisheries of the tropics. Whereas, in regions of high rainfall, tropical plant growth is luxurious on land, in the sea there is very little.

Although zooplantkon is to be found only where there are plants on which the animals can feed, it is affected also by the differences in the intensity of the light during day and night. Many planktonic animals move towards the surface at night, and away from it during the day. This diurnal movement is exhibited by calanus and it becomes important because they are followed by the feeding herring, particularly off the north-east coast of Great Britain in the early summer—the season of the Scottish herring fishing.

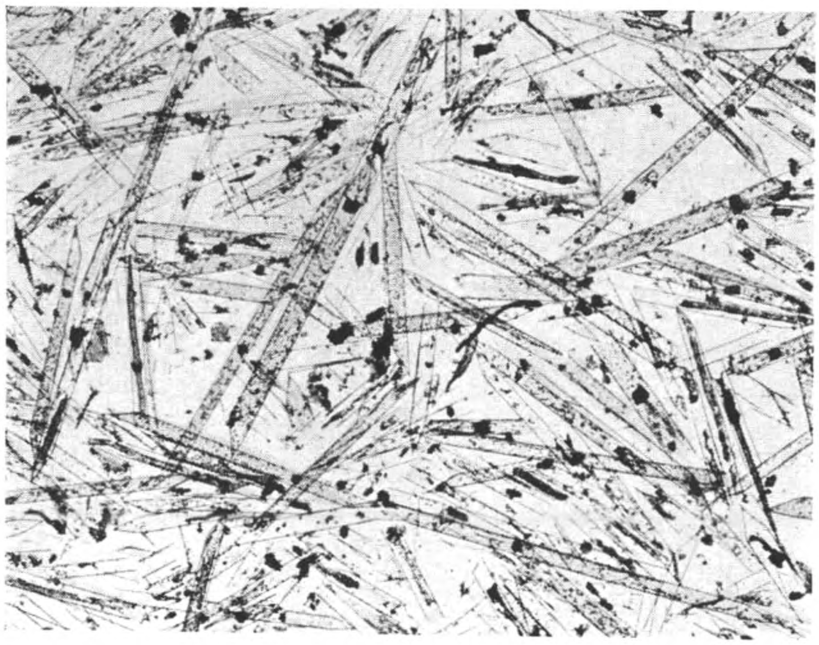


Fig. 4. *Rhizosolenia styliformis*, a diatom forming large patches which the herring shoals avoid

Phytoplankton has another effect on the herring, quite different from the one we have been considering. In the southern part of the North Sea dense patches of *Phaeocystis*, *Rhizosolenia* (Fig. 4) or *Biddulphia* sometimes develop in the autumn. The last two forms are diatoms, while the first belongs to a different group of unicellular plants. When these patches develop in the track of the herring, the autumn herring fishing does not start so soon and the fishing grounds may be displaced because the herring will not enter the dense patches. We do not know why. This phenomenon, however, is so important that prior to the war a research vessel was on duty each autumn finding the position of the phytoplankton patches and sending the information ashore by radio-telephony so that the fishermen could be advised where to go to avoid herringless water. It is hoped to resume the work this year.

Numerous other problems face the worker on plankton. To give but two examples ; (1) the question of the total productivity of the drifting population of the sea, a productivity which has a potential vastly greater than that of the most fertile land ; (2) whether by suitable means the addition of nutrient salts would not cause a denser population of the phytoplankton and thus ultimately bring about an improvement in the yield of our commercial fisheries. We cannot leave the subject, however, without calling attention to one of its most absorbing problems, namely, the interrelationships within the different communities of the plankton and between them and the larger creatures that feed on them. The physiological relation itself between the plants and animals is more complete than we have yet considered. The animals, besides depending on the plants for food, give off, as do the plants, carbon dioxide when breathing, and this carbon dioxide is used by the plants when building up cellulose, starch and fat, that is to say in photosynthesis. In their turn plants give off oxygen as a by-product of photosynthesis, and this is breathed by both the animals and the plants. There is thus a remarkably complex balance between the various living things that make up the plankton, a balance that only long years of research can finally elucidate.

A METEOROLOGIST'S EXPERIENCES ON A FLOATING WHALING FACTORY IN THE ANTARCTIC

BY H. H. LAMB, B.A.

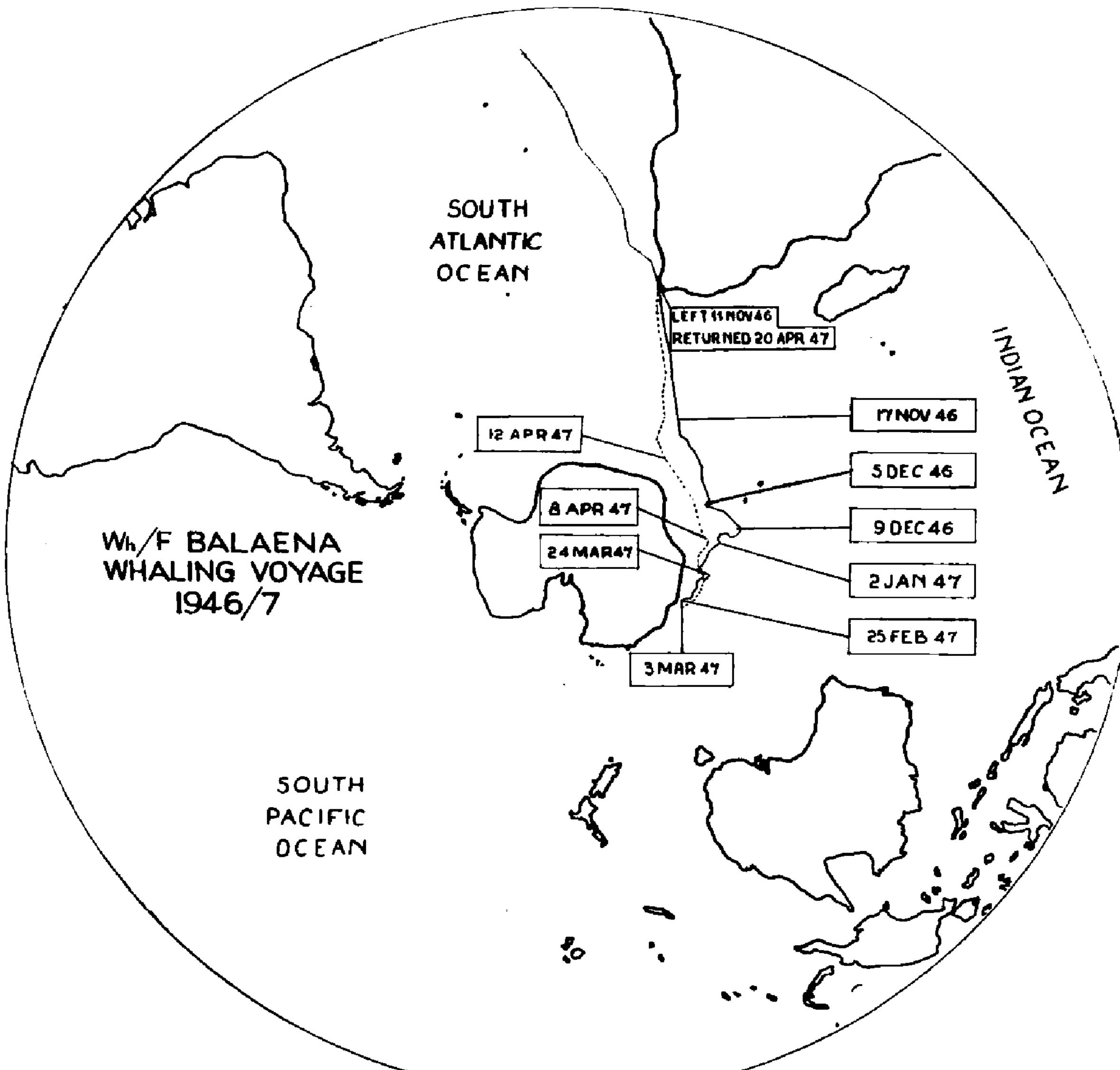
On Sunday, 29th September, 1946, in clear autumn sunshine, Britain's new whaling-factory ship, *Balaena*, made her way north through the Hebrides on the first day's steaming of her 27,000-mile whaling voyage. This maiden voyage was destined to produce in the Antarctic 185,000 barrels (over 30,000 tons) of whale oil, worth £2,000,000, to make margarine and cooking fats, soap and cosmetics for Britain and Europe.

The ship sailed from Belfast, where she had been built since the war by Messrs. Harland & Wolff at a cost of about £1,500,000 for United Whalers, Ltd., of London. She was to be a floating factory and the base for a fleet of 12 steam-driven whaling trawlers, commonly known as whaleboats or catchers, from which the whales are actually shot. These 200 to 300 ton vessels have a cannon mounted on a gun platform at the bows, and from this the harpoon is fired which kills the whale.

Balaena's 32,000 tons displacement gave little enough room for all the varied activities on board. Besides the rows of boilers, in which the oil was extracted from bones, flesh and blubber, after the 80-ton mammals had been dismembered on deck, and the plants for making by-products such as meat-extract and bone-meal, there was everything from a blacksmith's shop, where bent and used harpoons could be got ready for firing again, to a hangar and flight-deck astern with aircraft for use in whale spotting. The blunt-nosed bows of the factory ship were specially stiffened to meet pack ice, and her navigational equipment included both radar and radio direction-finding for controlling whaleboats and aircraft.

Safe operation of the aircraft also demanded the presence of a meteorologist. A previous attempt by a Norwegian whaling company many years ago to use an aeroplane in Antarctic waters had ended in disaster, with the loss of the aircraft and its crew in thick weather. The British Meteorological Office (Air Ministry) was therefore approached for the loan of a qualified meteorologist, whose responsibility would be to give advice regarding weather before and during every flight from *Balaena*. This proposal, which was bound to yield valuable experience and lead to the collection of data from an almost unknown region, was readily accepted. And when a volunteer was called for, I came forward hoping that several years experience of weather forecasting for the North Atlantic air route and some first-hand knowledge of weather in Iceland and Norway would help me in tackling the untried problems of the Far South.

Curiously enough the route from Belfast to the Antarctic whaling grounds lies by way of Norway, where the whaling crew is picked up, before heading south with calls at Southampton, the Canary Islands and Cape Town. The factory is manned by some 390 men of whom nearly 300 are Norwegians, mostly from old whaling families in the districts of Tönsberg and Sandefjord.



Some of these men have spent up to 40 seasons whaling in polar regions, north and south, but usually spending the slack summer season at home. For one elderly steward *Balaena's* expedition meant his 51st crossing of the equator.

The remainder of the crew were British, Irish, South Africans and a few others, including a Maltese barber who regarded the trip as a means of getting some money so that he could get back home to Malta and settle down.

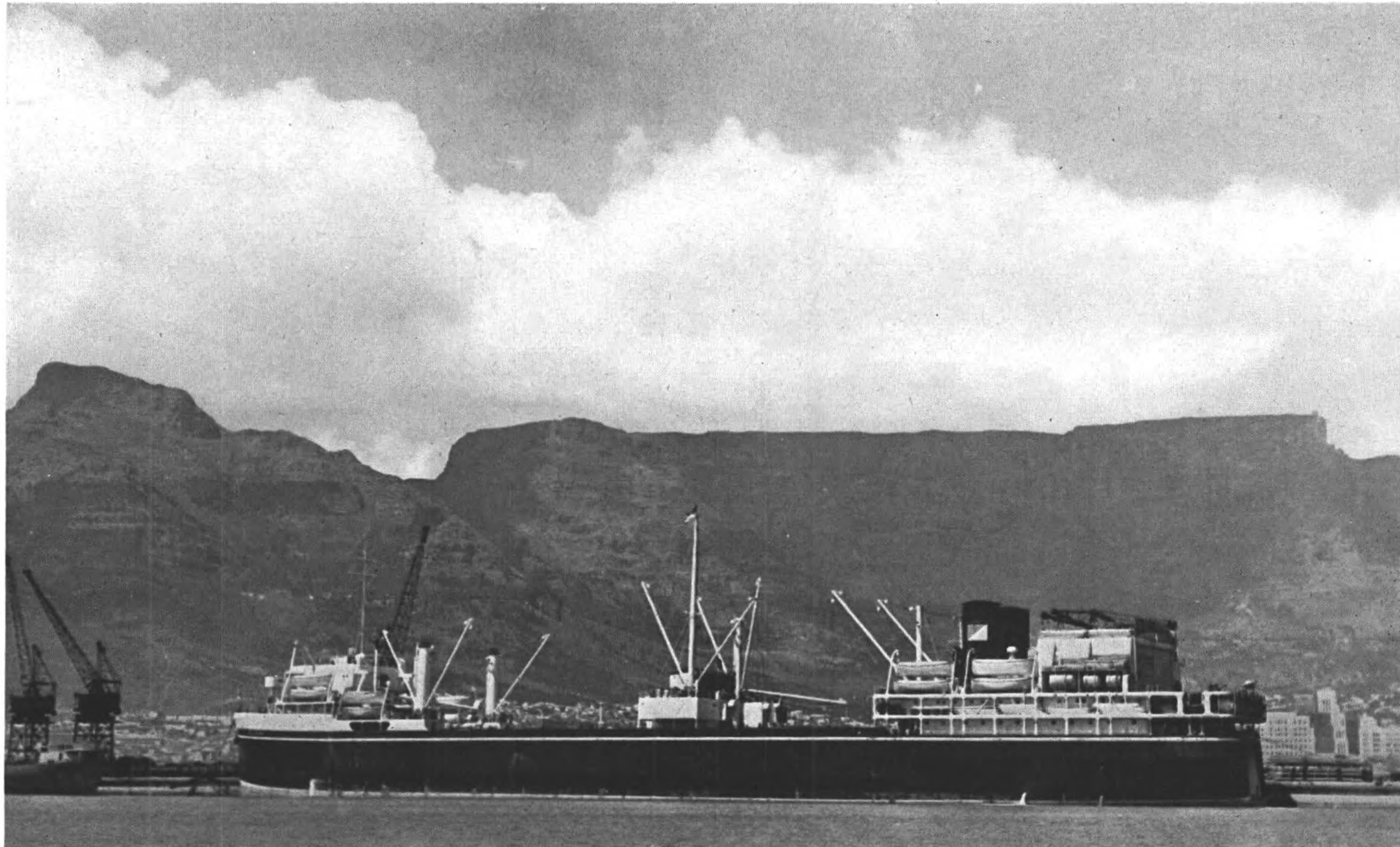
All the old timers in the whaling trade today are Norwegians. Few others will put up with the isolation of whaling for more than 3 or 4 seasons at most. The Norwegian engineers and officers of a whaler that is registered in a British port may only get 3 days to 3 weeks at home in the year and only a few days leisure in other ports. After leaving Cape Town for the whaling grounds there are 4 or 5 months without touching port. During those months the whaling fleet is like a small factory town or floating village, moving on through the silent, ice-strewn wastes of ocean. At nightfall there are always the lights of the other vessels round about to lessen the sense of loneliness ; but it is a community without womenfolk and in which the only breaks in the monotony are the occasional visits which can be made when a whaleboat comes alongside the factory for bunkering and, twice during the season, when a tanker comes with mail from home and fetches away the first lots of whale oil.

Balaena's aircrews were mostly British ex-Fleet Air Arm personnel, led by ex-R.A.F. Wing Commander John Grierson, who made the first solo flight across Greenland in 1934. The Royal Navy lent its experience and gave instruction in the catapult-launching of aircraft and their recovery from the water by crane.

The aircraft were three " Walrus " biplanes, driven by Bristol " Pegasus " engines. They normally flew about 1,000 ft at 80 knots when whale spotting, but did some special climbs to 10,000 ft. taking air temperatures. Although their work on whale spotting was successful, the whales were so unexpectedly plentiful that probably the most important work done by the aircraft during their 96 flying hours in the Antarctic was weather and ice reconnaissance and the photographing of previously unknown stretches of the coast of Antarctica between 80° and 110°E. The aircraft could take off from the water with a maximum free load of 1,400 lb. or be catapulted into the air carrying 1,600 lb., of which 100 to 120 lb. had naturally to be given up to emergency gear such as dinghy, tents, sleeping-bags and dehydrated rations for the three men on board.

My most vital concern as meteorologist on the floating factory was with the safety of aircraft and crew from weather hazards. The possibility also existed that weather forecasts might be of economic use in planning the next days' whaling operations, and several of the whale gunners, including the star gunner, Finn Ellefsen, gave it as their opinion that this was so, although some people who had been seasoned by many years' experience on the whaling grounds not unexpectedly insisted on relying upon their own judgment. My job was also to collect regular weather observations with the aid of an elaborate equipment, which included instruments for measuring air pressure, temperature and humidity and wind speed, as well as hydrogen balloons and theodolite for probing the wind currents in the the upper air. Meteorologists who have been in the Antarctic before have found that the observational work and constant care needed to keep instruments working properly under difficult conditions gave them a full-time job. I was soon to find that with 6 to 8 hours' work on top of this every day, in connection with forecasting the weather ahead, my hands were more than full.

The meteorological observer on a whaling factory must be prepared for some tantalising disappointments and chances narrowly missed. For instance, to follow with a sighting instrument (theodolite) the progress of a



The floating factory, *Balaena*, in Cape Town harbour (November, 1946). Table Mountain in background balloon to high levels requires a coincidence of several favourable circumstances, and if only one of these is missing the opportunity is lost. The ship must not be rolling too much and on a steady course, which rarely happens when whales are to be collected from scattered whaleboats ; and if the wind is nearly dead ahead, the ship's smoke streams astern and the balloon may be lost as soon as released. Then again there are wide stretches of the Southern Ocean where the sky is almost permanently covered with low cloud, and the occasional clearings once in several days do not last more than 3 or 4 hours. By careful watching for the opportunity a few wind values at considerable heights were nevertheless obtained, and in one case a balloon was observed to enter a cirrus-cloud layer at 43,500 ft.—higher than it had been thought possible for cloud to exist in these latitudes.

The chief disappointment in the forecasting work came right at the beginning of the season when it was discovered that no weather reports would be available from the other whaling ships, in spite of promised co-operation. This was a blow to morale from which a gradual recovery was made when it was realised that the weather maps and forecasts were working out surprisingly well in spite of all, owing to the evident regularity of the theoretical weather processes over the vast expanses of the Southern Ocean.

The weather south of 40°S was predominantly overcast until we got near the coast of Antarctica, where offshore winds may be too dry to produce any cloud at all. The sun then shines with dazzling brightness on a world of sparkling ice and gently-rippled, blue water, as clean and bright as any winter scene in the Swiss or Norwegian mountains, which makes one feel that all is worth while—a relief from the depression of grey weather and factory fumes and the scenes of carnage on deck.

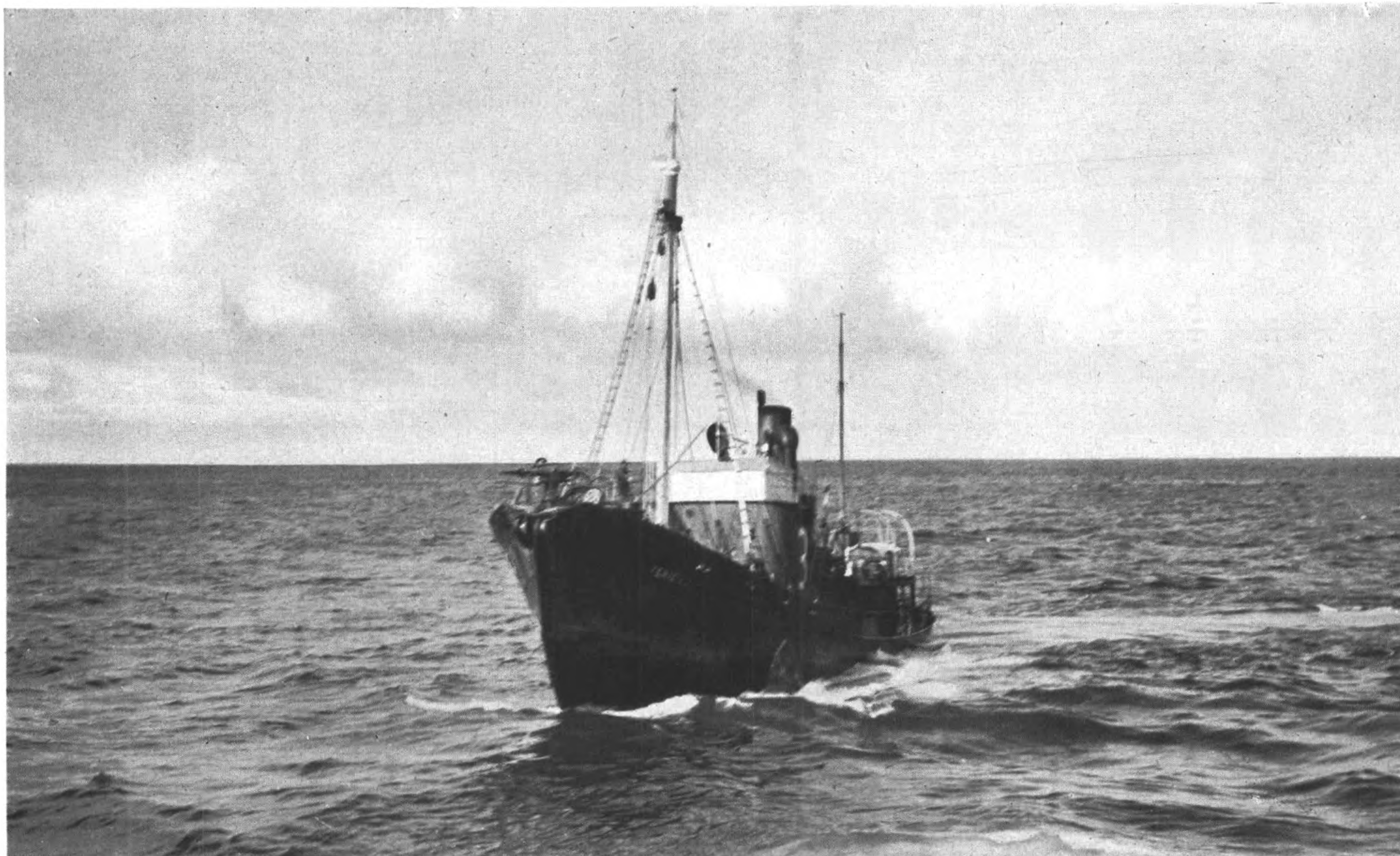
It is summer in the Antarctic during the first two months of the whaling season, from 8th December until about mid-February, and the temperature was mostly only a few degrees below the freezing point. The light summer nights of this period were sometimes very beautiful, producing shades of colour never seen in temperate latitudes.

The Southern Lights (*Aurora Australis*) were first seen on odd nights during March, in the southern autumn when the nights were getting dark. One of the strongest of these displays was also seen in Melbourne, Australia ; whilst that seen in 45°S on 17th April, 1947, on our homeward voyage, was at the same time that a display of *Aurora Borealis* was seen in the north and south of England.

Weather was regarded as fit for unrestricted flying up to the 6-hour range of the aircraft on 53 of the 141 days spent on the whaling grounds, and fit for local flying within easy recall on 37 other days.

Storms did not hinder us as often as had been feared. And the strange, smooth swell which rumples the icefields on certain days is manageable up to a wave height of 10 to 20 ft. for aircraft alighting on water screened by ice from the roughness of the open sea.

All flying in snow and in cloud was avoided as far as possible on account of the risk of ice-crustration on the aeroplane as well as the nuisance of bad visibility. Anti-icing paste is not handy for use on biplanes with many struts and crosswires. There were frequent short periods of snow and occasionally fine drizzle, but the amount of moisture brought down in four months was as small as the normal for the Australian desert. It may well



A typical " catcher " or whaleboat. Notice the whale-cannon, with harpoon loaded, at the bows. A whale that has been caught is being towed, tail foremost, at the nearer side.

be that much of the ice crust of the South Polar continent is formed by direct deposit of ice from damp clouds. This form of icing, which is so dangerous to aircraft, produced very thick coatings of ice on the rigging and wireless aerials of the ship on the rare days of fog and mist.

From all points of view the 1946–47 whaling season, whilst Europe shivered, seems to have been an unusually fine summer in the Antarctic. Nevertheless the characteristic suddenness of changes of the weather, wind and visibility still held as much danger for flying.

The fog and snow which we experienced were nearly always arranged in distinct belts, usually continuous along their length but occasionally withering to mere patches along a line. These belts of thick weather were mostly narrow, from 5 to 25 miles across, but occasionally in bigger storms much wider than that. The intervening spaces were usually clear, or at worst, cloudy with good visibility.

The secret of weather forecasting was to spot the pattern and distribution of these belts of thick weather, their movement and any developments in them. This had to be done by very indirect reasoning, since weather observing stations from which reports could be received are few and far between in the Southern Ocean. There are not many islands, and few of these are pleasant places for habitation. The South Atlantic sector is fairly well covered: observers have long been stationed on the Falkland Islands, Tristan da Cunha, South Georgia and the South Orkneys, whilst the British meteorological observers newly stationed at Neny Fjord, in latitude 68°S in Graham Land, are doubtless the most southerly inhabitants of the globe. East of South Africa, however, there are no inhabited islands south of 50°S until one comes to the New Zealand sheep farm and weather station on Campbell Island in 52½°S, 169°E.

Reports from the other whaling factories would have helped, but whaling is such a highly competitive business that the factories keep their positions secret during the fishing season. There were therefore virtually no other ships' observations available, except when a tanker was approaching or a whaleboat out on longer reconnaissance. It is a strange circumstance that more observations were made of weather south of 40°S at the beginning of the century, when sailing vessels still went far south to take advantage of the Brave West Winds on the great circle courses between the southern continents, than are made today. At that time also the sealers lived on the lonely and now uninhabited island of Kerguelen in 50°S, 70°E and made observations.

Using the remote observation points on land and the reports from South America, South Africa and Australia, it was possible to map out broadly the extent and flow of the main air currents of the Southern Hemisphere from day to day, and thereby to arrive at an idea of the pattern of disturbances regularly formed on the boundaries of unlike airstreams. This pattern should reflect itself in the alignment of the cloud systems which came towards us. And the fact that it was possible to relate the weather map based on reports from places thousands of miles away to our own observations and the features of our visible sky, shows how regularly the theoretical processes work themselves out over the world's widest ocean. Yet although experience showed that one knew what to look out for in this way, there was still a wide margin for error in the exact position and probable time of arrival of individual belts of thick weather in our vicinity. It was actually easier to give an idea in

Tanker alongside the floating factory, in January, receiving our first oil production for shipment home. Notice the three whales inflated with compressed air and used as fenders.

general terms of the character of the weather to be expected in the next 24 to 48 hours, than to time a given change even a few hours ahead.

This difficulty was overcome by a special technique in flying operations. The systems of thick weather south of 60°S advance at about 10 to 20 m.p.h. in most situations during the Antarctic summer, though these figures may be doubled in the Roaring Forties or anywhere between 40° and 60°S. When snow or fog was believed to be in the offing, the aeroplane could therefore fly out towards it for 30 to 50 miles to establish either the exact position of the bad weather system or a minimum range of clear weather, before proceeding on another course to complete its mission.

On other days, when bad weather was still nearer, flying was carried out in liaison with whaleboats up to a restricted distance. Meanwhile a watch kept on the 10 miles distant horizon from a lookout above the navigation bridge of the factory would enable the aircraft to be recalled safely by radio-telephone within half an hour, beating the weather in some cases by a few minutes.

These methods proved safe in our experience. We returned to Europe with a cargo of vitamin-rich oil and with the credit of the first clean safety record in a flying venture of this kind. In the process some very interesting weather maps have been collected showing the play of weather and air currents over the Southern Ocean ; for 10 days these were experimentally extended right across the South Pole, with results which appear logical and consistent. These results should be interesting to Australia and New Zealand, which have announced their intention of establishing weather observing stations in Antarctica. The work also has analogies which throw light on Northern Hemisphere problems ; whilst the lesson of the advantages of close liaison between flying and the weather service in a difficult situation is applicable everywhere.

THE IMPORTANCE OF SHIPS' OBSERVATIONS TO THE FORECASTER

BY T. H. KIRK, B.SC.

Part II. Theoretical Aspects of Synoptic Analysis

1. Introduction

Before a clear idea of the forecaster's difficulties can be obtained it is necessary to examine some of the fundamental ideas on which forecasting practice is based.

Analysis implies *diagnosis*. We shall not go far wrong if we think of diagnosis in its medical sense. The medical man views his patient through a pattern of symptons. His examination reveals the patient's present state of health by a thorough checking of all the evidence available. Diagnosis is an essential preliminary to a cure. The meteorologist does not claim to be able to " cure " the weather but his diagnosis is as necessary in its way as is the physician's. The estimate of " progress " made by the meteorologist, framed in orthodox language, becomes the weather forecast.

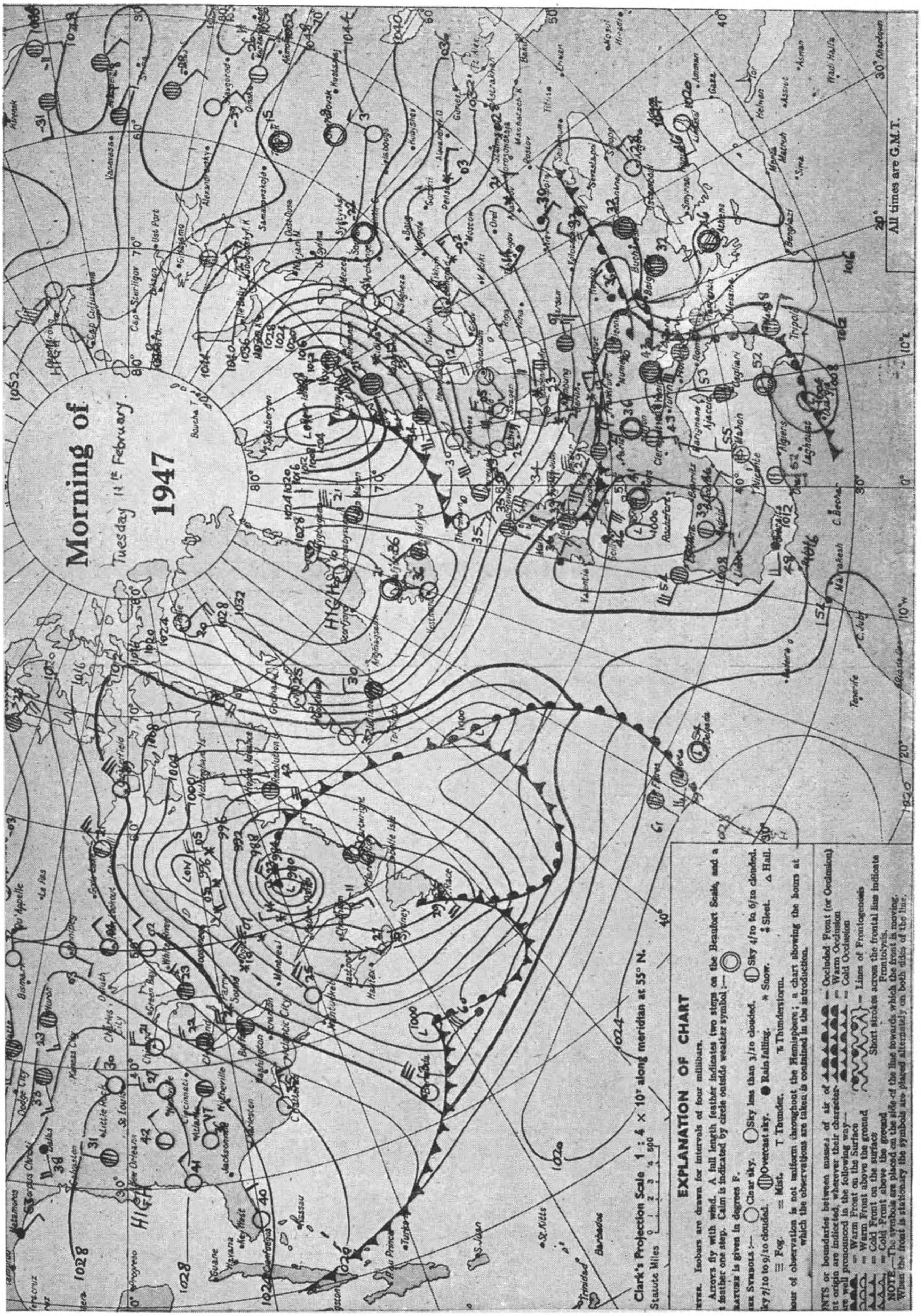

Morning of
Tuesday 11th February
1947
EXPLANATION OF CHART
Clark's Projection Scale 1 : 4 × 10⁷ along meridian at 55° N.
Statute Miles
All times are G.M.T.

Fig. 1

Fig. 1 shows a modern weather chart (actually part of the Daily Weather Report). Some of the changes in form that have taken place throughout the years may be seen by comparing this chart with Figs. 1 and 2 of Part I of this series. The outstanding difference is the appearance of " fronts " on the modern chart. These are shown as thick black lines looking somewhat like lace trimmings.

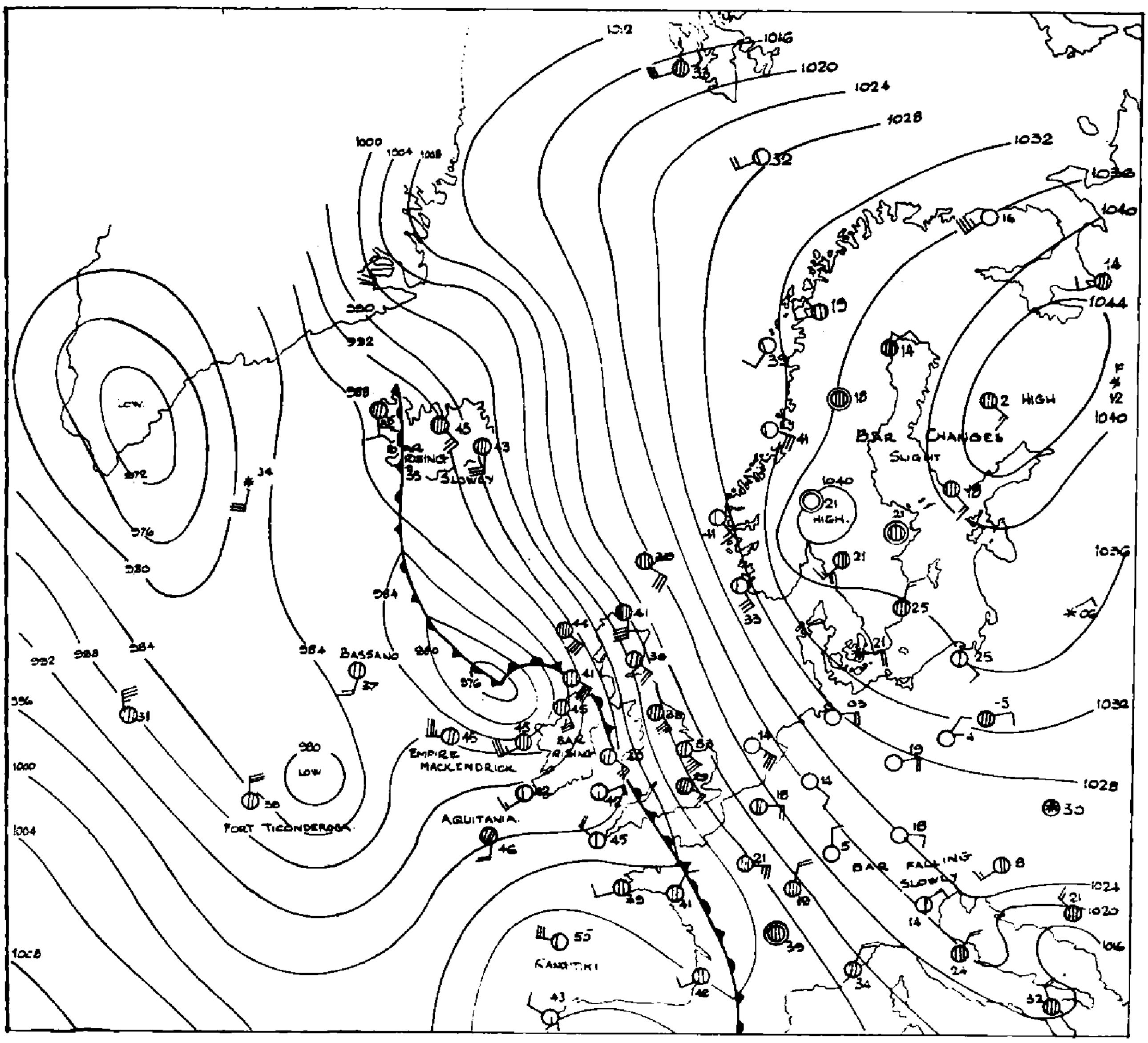


Fig. 2. Synoptic chart for 0600 G.M.T. on 6th January, 1947

2. Air-mass Analysis

The idea of fronts can best be appreciated through the more fundamental concept of *air mass*. An air mass is a mass of air that is largely homogeneous in horizontal extent over areas of the order of thousands of square miles. Fig. 2 shows a well-defined illustration drawn from the recent severe winter. As is typical of so many winter situations, pressure was high over the continent, the centre of highest pressure being over the extreme NW of Russia. This high pressure system effectively controlled the flow of air over most of Europe, bringing the low temperatures characteristic of the Russian winter.

The passage of the air over the relatively warm North Sea resulted in somewhat higher temperatures on the east coast of Britain. Nevertheless there was a marked difference between the temperature and other characteristics of this air and the milder air being brought in from the Atlantic round the low-pressure system west of Ireland. The dividing line between these two types of air mass is shown as extending from Tiree to Cherbourg, thence SSW.

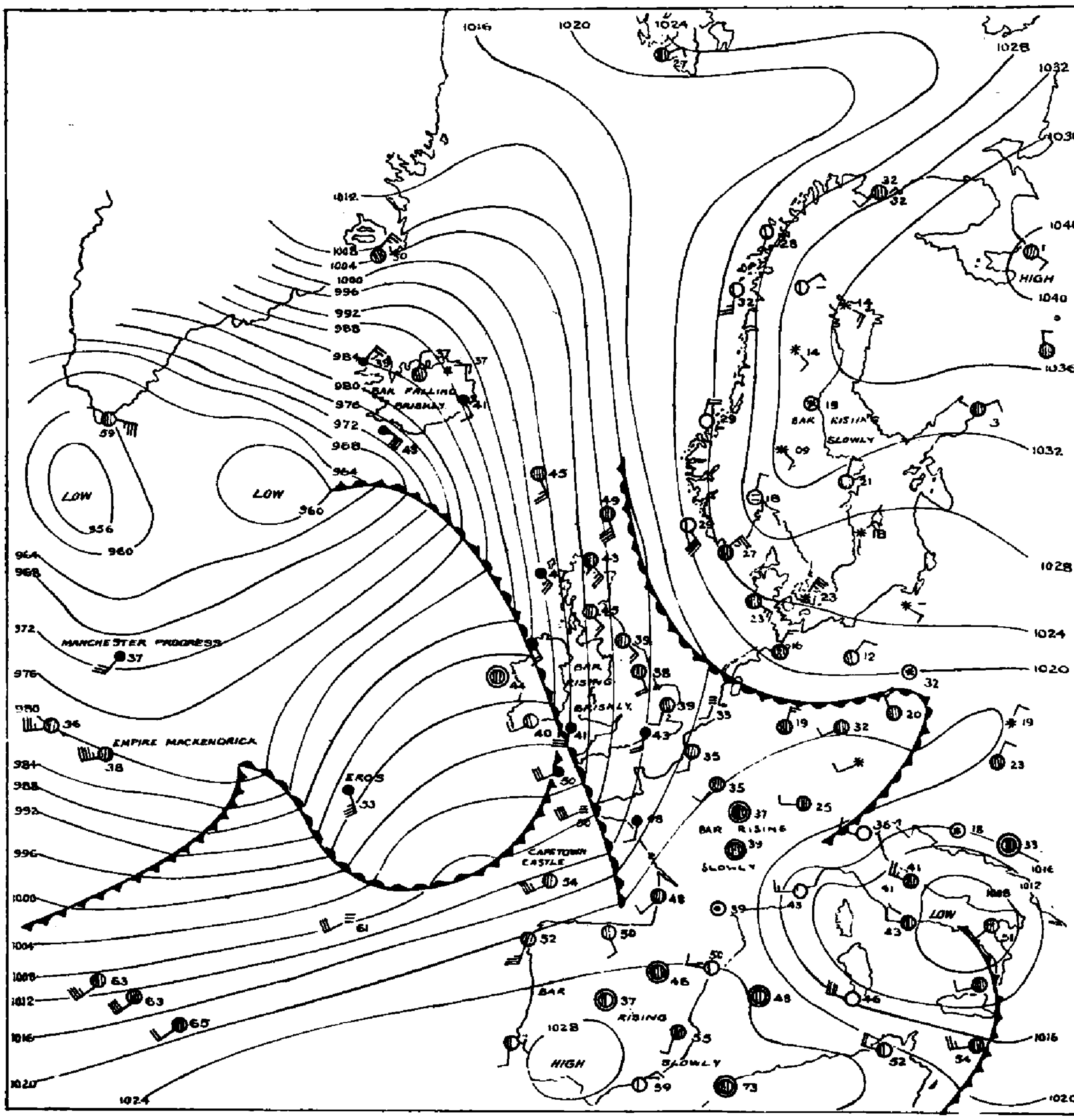


Fig. 3. Synoptic Chart for 1800 G.M.T. on 10th January, 1947

A rather more typical illustration is given in Fig. 3. Here the situation is more complicated inasmuch as more air masses are involved. The coldest air over the Scandinavian and Baltic countries had its origin in Russia, being brought round the continental high-pressure system. We may refer to this air mass as " continental polar " air, while the different air mass over the British Isles may be called " maritime polar " air, indicating that while the air is of polar origin its characteristics are those of an air mass formed over the sea. Warmer air from the SW is shown approaching France, high temperatures and fog patches characterising this air mass which may appropriately be classified as "maritime tropical". This tropical air is separated from the maritime polar air shown by the observations of the S.S. *Empire Mackendrick* and S.S. *Eros* by the frontal system associated with the secondary depression.

Air masses are formed in parts of the world (oceans, deserts, snowfields) where the underlying surface is sufficiently homogeneous to ensure a like horizontal homogeneity in the superposed air, which then gradually assumes properties imposed by the nature of the surface. Air stagnating over the frozen seas or snow-covered lands is cooled from below and when it eventually moves into lower latitudes may be described as "cold" in comparison with air from another quarter. Conversely, air originating in desert lands carries the characteristics of its origin into more northern climes, bringing them a subtropical heat diminished only by the modifying processes encountered *en route.*

Air masses in motion are in general being "modified" in many ways. Cold air may be heated from below and if over the sea will absorb large quantities of water vapour derived from the sea surface. Instability showers and thunderstorms are the products of this modifying process. Warm air, cooled from below by the sea surface, becomes laden with fog as it moves towards higher latitudes. The sea surface thus plays an important role in modifying the air masses that are later to affect the adjacent land areas. The meteorologist needs to study the changes that are taking place and to assess their effects when he makes his forecasts. His only information over large ocean areas is derived from ships' reports.

Sufficient has been said to stress the importance to the forecaster of knowing as much as possible about all the air masses shown on his chart; where they have originated, how they have been modified, and what further changes are likely before one or another affects the forecast area.

Weather processes occur not only within the different air masses but, on a more important scale, at the boundaries between them. These boundaries must be of the nature of surfaces if we think in three dimensions, and choose to neglect the effects of mixing which are generally small when judged in terms of the large expanses occupied by the air masses. The reason why extensive mixing does not occur is twofold: (*a*) the air masses have different properties; (*b*) they are in motion relative to each other. The boundary surfaces between different air masses are known as "frontal surfaces", the intersection of such a surface with the horizontal being known as a "front". Examples of fronts are shown as thick black lines in Figs. 1, 2 and 3. To a casual onlooker the analysis of a chart might appear to be a matter of front finding. While this is undoubtedly of great importance it should be remembered that the drawing of fronts is secondary to the identification of air masses. The distinction is not mere pedantry and represents a real difference of approach.

3. Fronts in relation to depressions

The ideas behind air-mass analysis may be applied in any part of the world without restriction. In the temperate zones the analyst has at his disposal a standard picture or model in which the air-mass ideas are linked with the structure and development of the depression. This synthesis, usually associated with the name of Bjerknes, is of fundamental importance. It provides the forecaster with a basic pattern or tool for everyday use. Synoptic situations, when analysed, appear as variations on a fundamental theme—the Bjerknes model.

This model shows the depression no longer as a symmetrical vortex or whirl but as an entity in which a certain asymmetry is essential to its development. The structure of a newly formed depression as it appears on a working chart is shown in Fig. 4. To an observer at any point along the

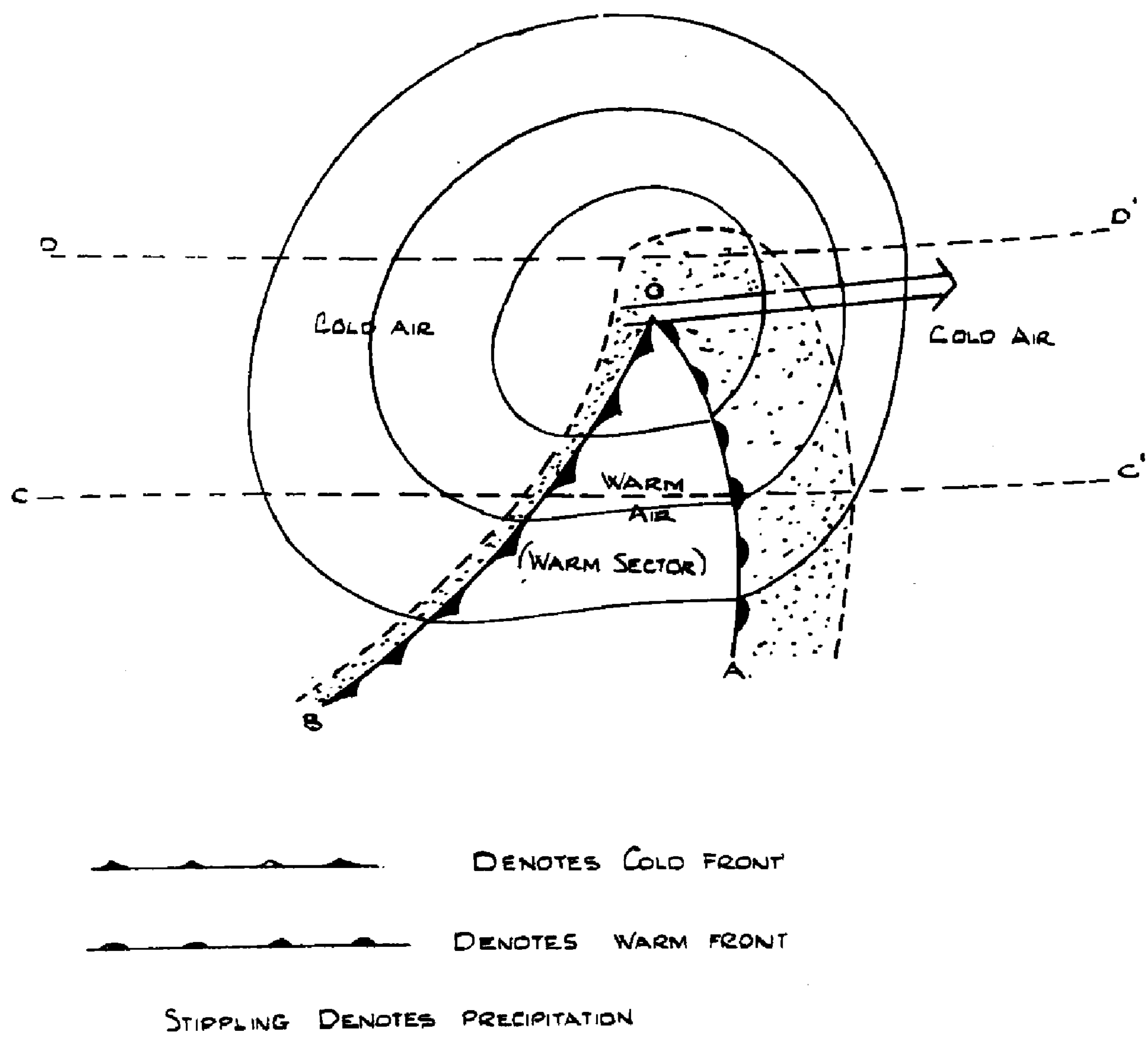


Fig. 4. Typical Bjerknes' Depression (as seen on Synoptic Chart)

line OA, warm air at the surface is replacing cold air. The line OA is therefore known as the " warm front " of the depression. Similarly OB is the " cold front ", or line along which cold air at the surface is replacing warm air. The thick arrow drawn from the centre of the depression shows its direction of movement. Shading indicates precipitation, which is predominantly associated with the frontal boundaries.

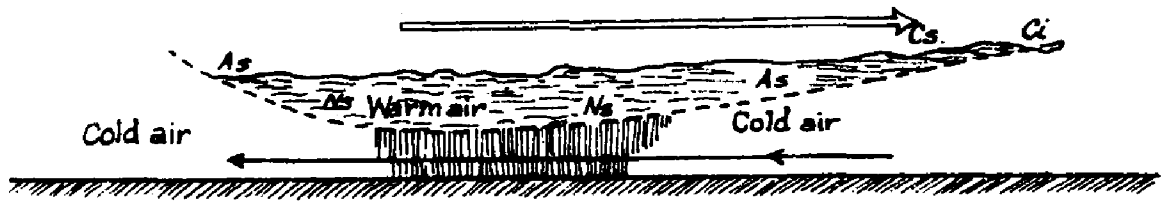
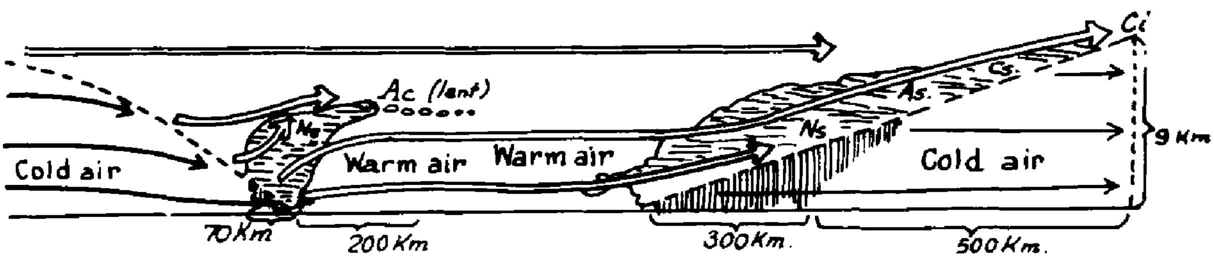


Fig. 5. Section of the typical depression

(*a*) Section DD′ north of centre



(*b*) Section CC′ south of centre

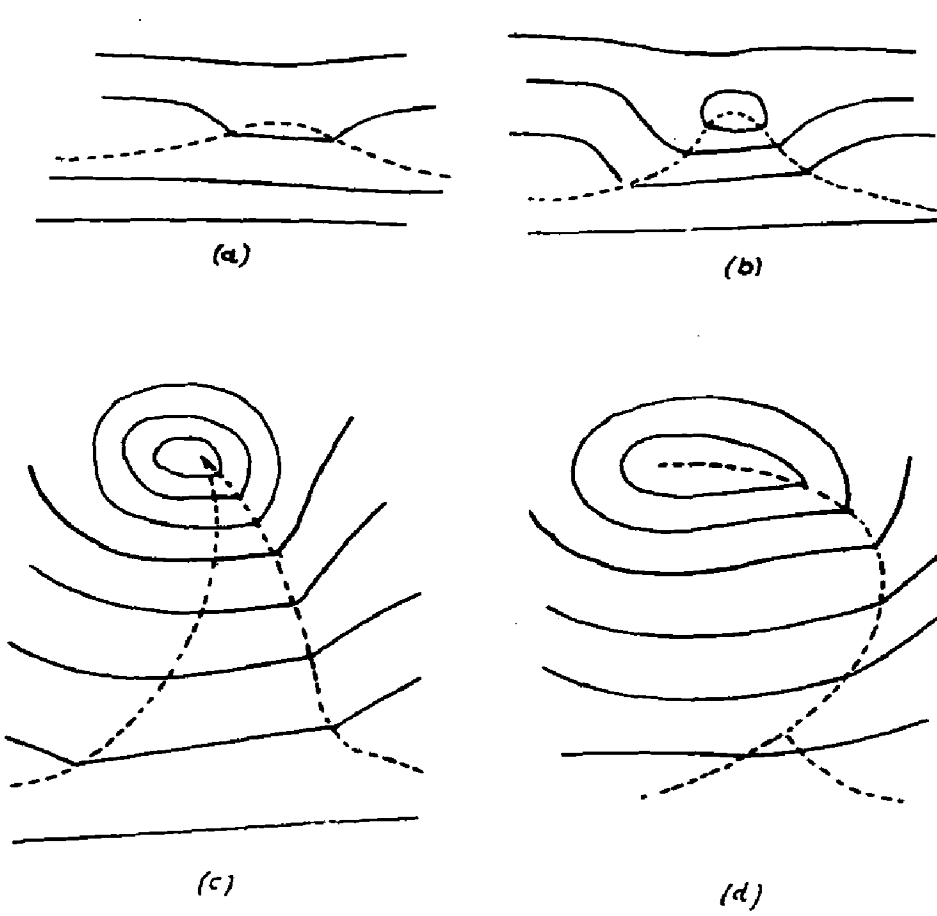
The physical processes involved are illustrated in Fig. 5, which shows two vertical cross sections of the depression, one intersecting the warm sector and the other just outside it.

4. Life History of depressions

The strength of the Bjerknes conception lies in the fact that it views the depression as a developing organism undergoing growth and decay. In other words the depression is viewed from the " life history " standpoint so familiar in school biology. The birth of a depression is visualised as occurring at the frontal surface between two air masses. The actual mechanism is unknown, but development occurs as the centre deepens and the circulation around the depression increases. The frontal system plays an essential part in this deepening process. Fig. 6 shows the essential stages in the development and decay of a depression. The figure is largely self-explanatory, except for the process of " occlusion ". It is found as a matter of experience that the cold front moves faster than the warm front and gradually overtakes it, first near the centre of the depression where the two fronts are close together, and then progressively further from the centre. The overtaking of the warm front by the cold front implies that the warm air has been lifted from the ground. There is still, in general, a discontinuity of air mass at the surface between the air that was originally in advance of the warm front and the faster moving air in the rear of the cold front. This line of discontinuity is called an " occlusion ". The weather sequence associated with an occlusion is usually more complex than that associated with either a warm or a cold front. The extent to which occlusion has taken place in a depression is a convenient index to its age.

5. Historical Sequence

There is a fundamental principle which is of great use in the analysis of weather charts. This is that any chart should follow logically from the previous one. The word " logically " implies that the displacements of the



Stages in the development of a depression

(a) Wave formation
(b) Deepening depression
(c) Fully-developed depression
(d) Occluded depression (usually filling)

fronts should be in accordance with the observed wind field and that the whole process of change should be a continuous one. Where new features are introduced on a chart it must be possible to account for their introduction on a historical basis. For example, where a new front has been introduced it is essential that it be shown as the result of a front-forming or " frontogenetical " process already in evidence on a previous chart. Fronts are discarded only when a front-dissolving or " frontolytical " process indicates that this is permissible.

When charts are drawn at frequent intervals, say every 3 hours, this principle may be used as a supplementary aid in areas where but few observations exist. The greater time interval of 6 hours between ship's observations limits the utility of this principle and makes essential an adequate distribution of reliable observations, at each synoptic hour, if good analyses are to be obtained.

6. Pressure Distribution—the basis of calculation

The pressure distribution or pattern of isobars has long been recognised as of fundamental importance. Modern methods of analysis by no means diminish the importance of a detailed study of the isobaric picture. Isobars have the virtue of providing a continuous picture in terms of which processes of change can be assessed. They provide the everyday language of the synoptic chart; the depression becomes the "low", i.e. centre of low barometric pressure, and the anticyclone is referred to as a "high". We talk of "cols", of "ridges" and "troughs", all part of the isobaric picture language.

The movements of the various isobaric systems afford, in a rough and ready fashion, an explanation of the main changes of weather. This fact has been known since early days and at that time was the mainstay of the forecaster who endeavoured to formulate all his explanations in terms of isobar patterns.

The introduction of the Bjerknes model in conjunction with the methods of air-mass analysis has relegated the method of isobar patterns to a less prominent place. Explanations are now sought in terms of more tangible physical properties; but it is still true to say that the isobaric pattern or "pressure field" plays a fundamental role, inasmuch as it provides the means of dealing quantitatively with the processes of change. If we consider a distribution of straight isobars equally spaced, a distance "b" apart, the isobars being for intervals of 2 millibars, then the "pressure gradient", which is the slope of pressure per unit distance, is equal to $\frac{2}{b}$. If we denote this for convenience by the letter G, then we have an important relationship involving G. It is found that if the wind be measured above the earth's surface at a height of 2,000 ft., where surface friction effects become small, then in temperate and high latitudes, this wind has a speed nearly proportional to the pressure gradient G, and a direction along the isobars in accordance with Buys Ballot's law.

How the does surface wind compare with this wind at 2,000 ft. (referred to henceforth as the Geostrophic Wind)? The answer depends on the amount of obstruction afforded by the earth's surface. Over land, where buildings and trees provide the large-scale friction of which we are speaking, the surface wind speed is only about one-third of the Geostrophic Wind speed, and the direction is not exactly along the isobars but deviates towards the low pressure side. Owing to the variable amount of surface friction, both surface wind speed and direction bear no really fixed relation to the Geostrophic Wind. At sea, however, there is but little surface friction and this is relatively constant. The surface wind speed may be reckoned to be about two-thirds of the wind speed derived from the isobars, and the direction only slightly deviated from that of the isobars. We thus see, in rough fashion, how it is possible to relate the measureable quantity "wind" to the pressure distribution, and how the relationship is simplified where motion is over the sea.

The pressure distribution and its changes with time provide a means of estimating the displacements of fronts, of depressions and other features of the isobaric pattern. These estimates of displacement form the foundation on which forecasts are built. Slight errors in the estimates may on occasions lead to major differences in the forecast.

7. What is required of an analysis?

It is perhaps advisable at this stage to reconsider, first, what is required of an analysis and, secondly, in what way ship's observations may be of special importance.

The analysis is a necessary preliminary to the forecast, an accurate analysis paving the way towards a good forecast. Such an analysis should show :—

(*a*) the positions of depressions, anticyclones and other features of the pressure distribution ;

(*b*) the extent and indentifying properties of the different air-masses involved ;

(*c*) the relation of the air-mass boundaries, or fronts, to the depressions ;

(*d*) accurate drawing of isobars, especially in the vicinity of fronts ;

(*e*) a consistent development from the previous analysis.

Over the greater part of the sea areas the number of ships' observations is still inadequate to ensure the accurate fixing of positions of barometric features. In drawing up the chart, the forecaster must perforce place great reliance on any particular ship report that might be available. Whereas on land, adjacent observations may be used for confirming or checking any individual observation, this is generally impossible at sea and the observation must be accepted at face value. Hence the need for a high standard of accuracy of ships' observations.

A similar consideration applies when ships' observations are used in air-mass analysis. However, in this case, owing to the fact that ships' observations are in general more representative of the air mass than are land observations, much can be done with surprisingly few observations, provided these are adequately distributed over the area of the chart and are completely reliable. Deductions made from a single ship's observation may have far-reaching consequences.

THE SEVERE GALES OFF THE COASTS OF THE BRITISH ISLES, 23rd-24th APRIL, 1947

BY C. A. S. LOWNDES

At 1710 G.M.T. on the 23rd April, 1947, the British steamer *Samtampa*, bound for Newport from Middlesbrough, went aground and broke up near Porthcawl. The whole of the crew of 40 lost their lives.

Heavy seas were running and a strong SW'ly gale was raging when the Mumbles lifeboat, *Edward, Prince of Wales* put out to the wreck at 6 p.m. After returning to secure additional information shortly afterwards, she put back towards the wreck, and nothing more was seen of her until the following morning when she was sighted upturned alongside the wreck. Her gallant crew of eight lost their lives. (The last occasion when a lifeboat and her entire crew were lost was on 15th November, 1928, when the Rye lifeboat, called out to assist the Latvian steamer *Alice*, was capsized by a heavy sea. Her crew of seventeen lost their lives.) On the same day, the Spanish trawler *Cantabra Rosa Maria*, caught in the gale off the south coast of Ireland, was lost with all hands 80 miles south of Fastnet. Many other trawlers reached harbour badly damaged.

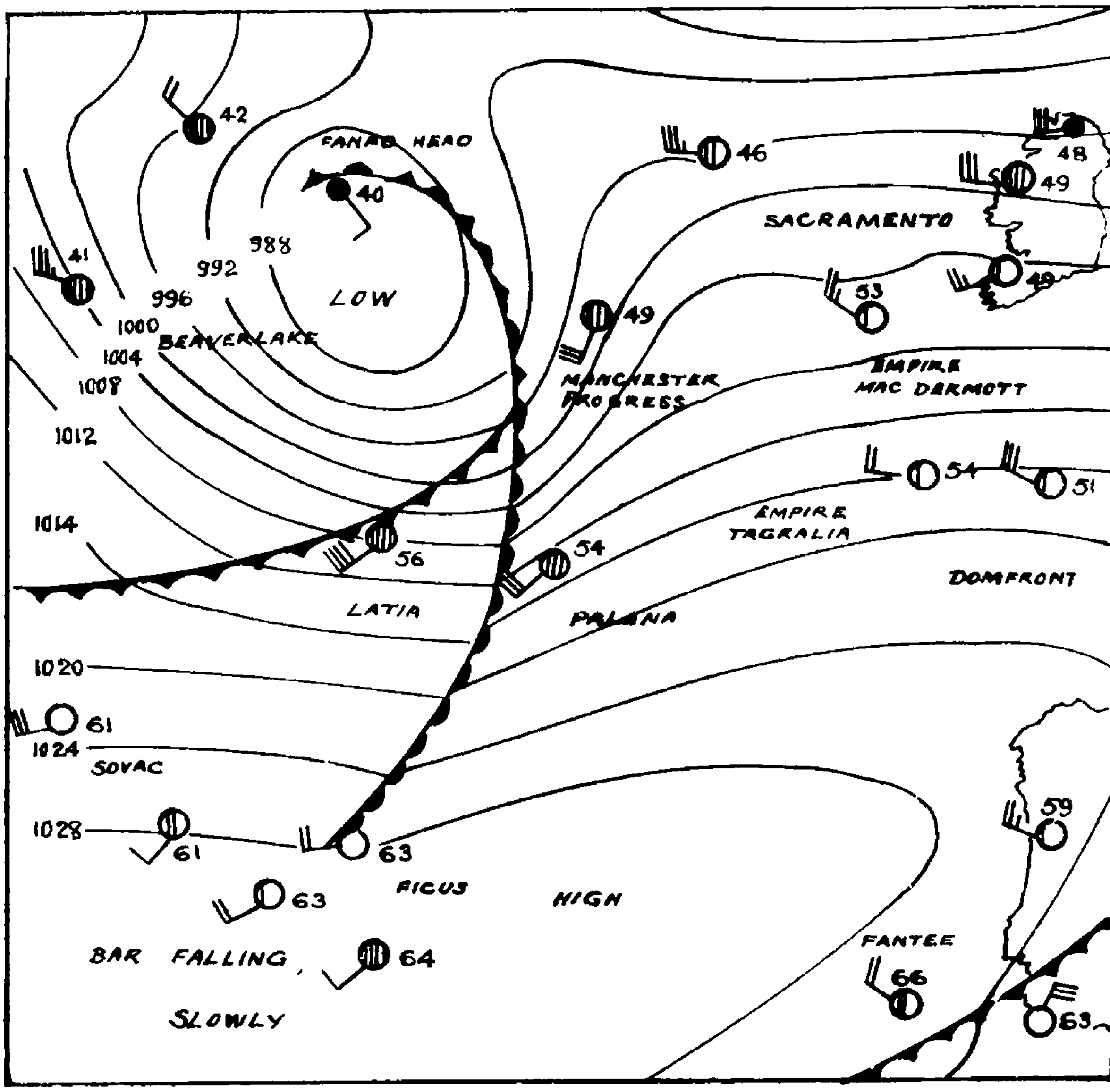


Fig. 1. Synoptic Chart for 1800 G.M.T. on 22nd April, 1947

A warning that S to SW gales were expected to be renewed the following morning in sea areas Shannon and Fastnet was broadcast to shipping at 1540 G.M.T. on the 22nd. The synoptic situation at 1800 on the 22nd (see Fig. 1) showed a depression centred at about 51°N 30°W, deepening and moving in a NE'ly direction. It is interesting to note the important part played by ships' observations in determining the position of the centre of the depression, and the pressure at the centre—988 mb.

At 0215 on the 23rd, a warning was broadcast that S to SW gales were imminent in area West Channel, and later at 0330 that gales were expected to be severe in areas Fastnet and West Channel.

The situation at 0600 on the 23rd is shown in Fig. 2. The depression had moved NE and was now centred off NW Ireland, the pressure at the centre having fallen to 968 mb. The associated occlusion was situated off the west coast of Ireland. The wind at Valentia was reported as SW force 8. A further broadcast at 0620 gave warning of severe S'ly gales, veering SW to W, reaching force 10 at times, expected in all sea areas around the coast of the British Isles.

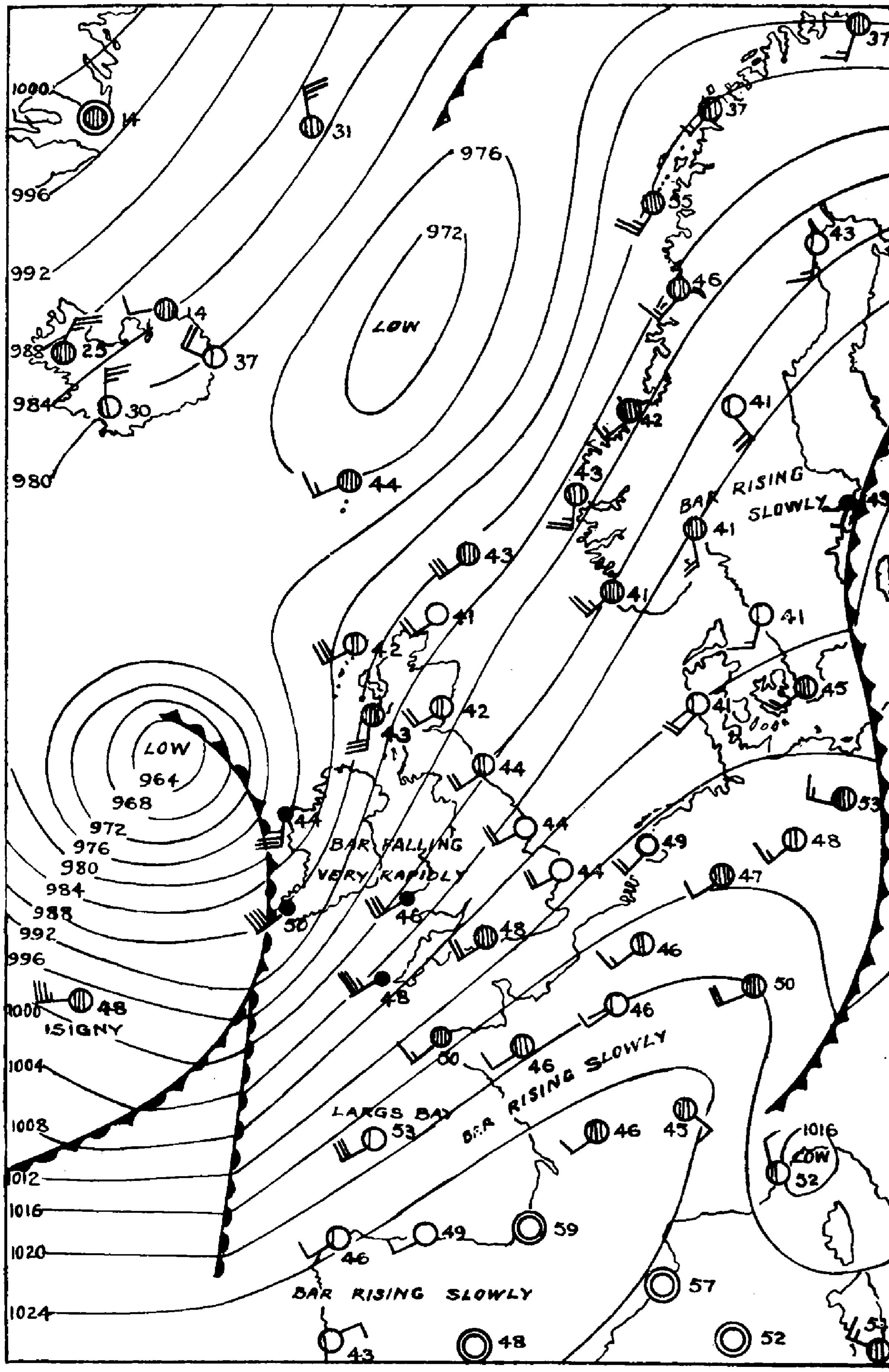


Fig. 2. Synoptic Chart for 0600 G.M.T. on 23rd April, 1947

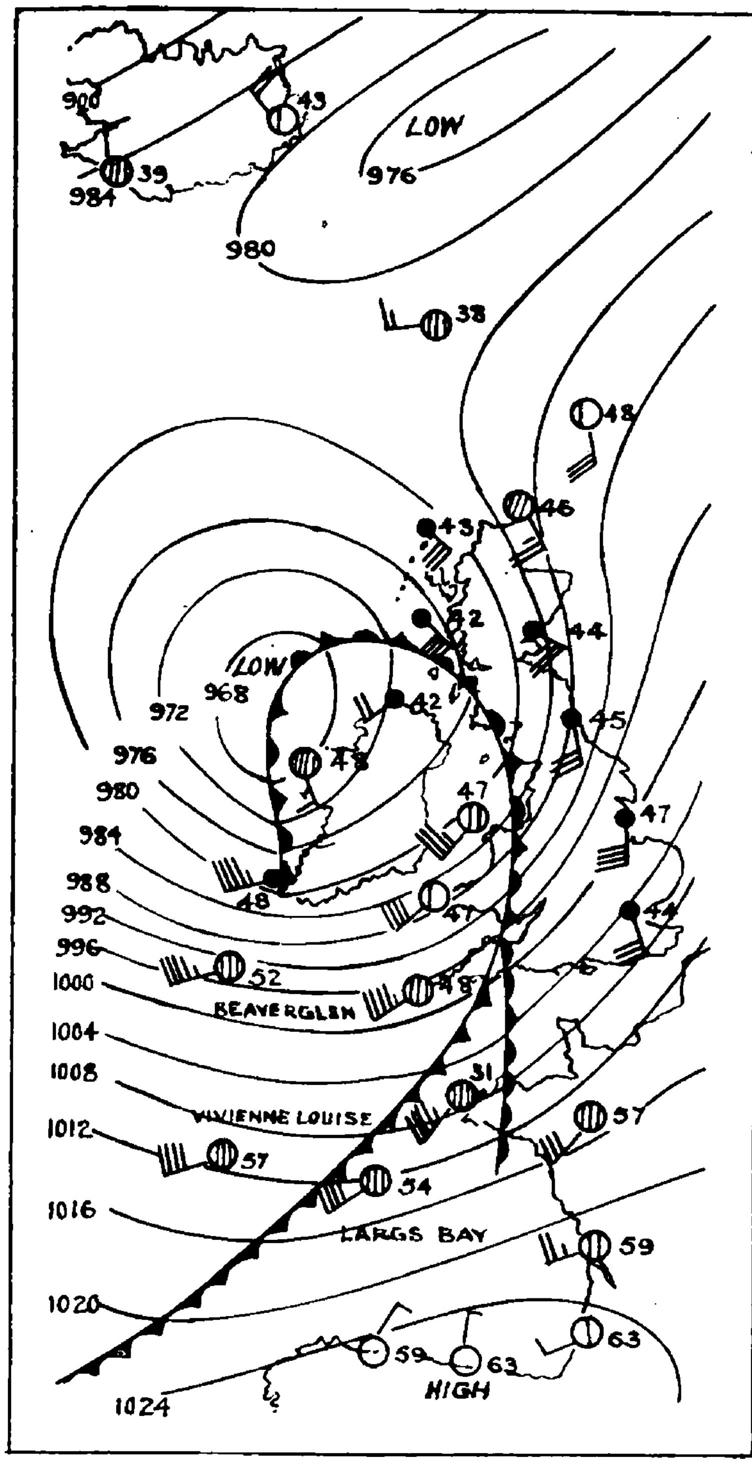


Fig. 3. Synoptic Chart for 1200 G.M.T. on
23rd April, 1947

Fig. 3 shows the situation at 1200, with the depression centred just off NW Ireland, and the associated occlusion assuming a " bent-back " formation. The pressure at the centre was 968 mb., the same as at 0600, indicating that the depression was no longer deepening. The pressure gradient to the S of Ireland was now very steep ; Valencia, Scilly and S.S. *Beaverglen* all reporting wind force 9.

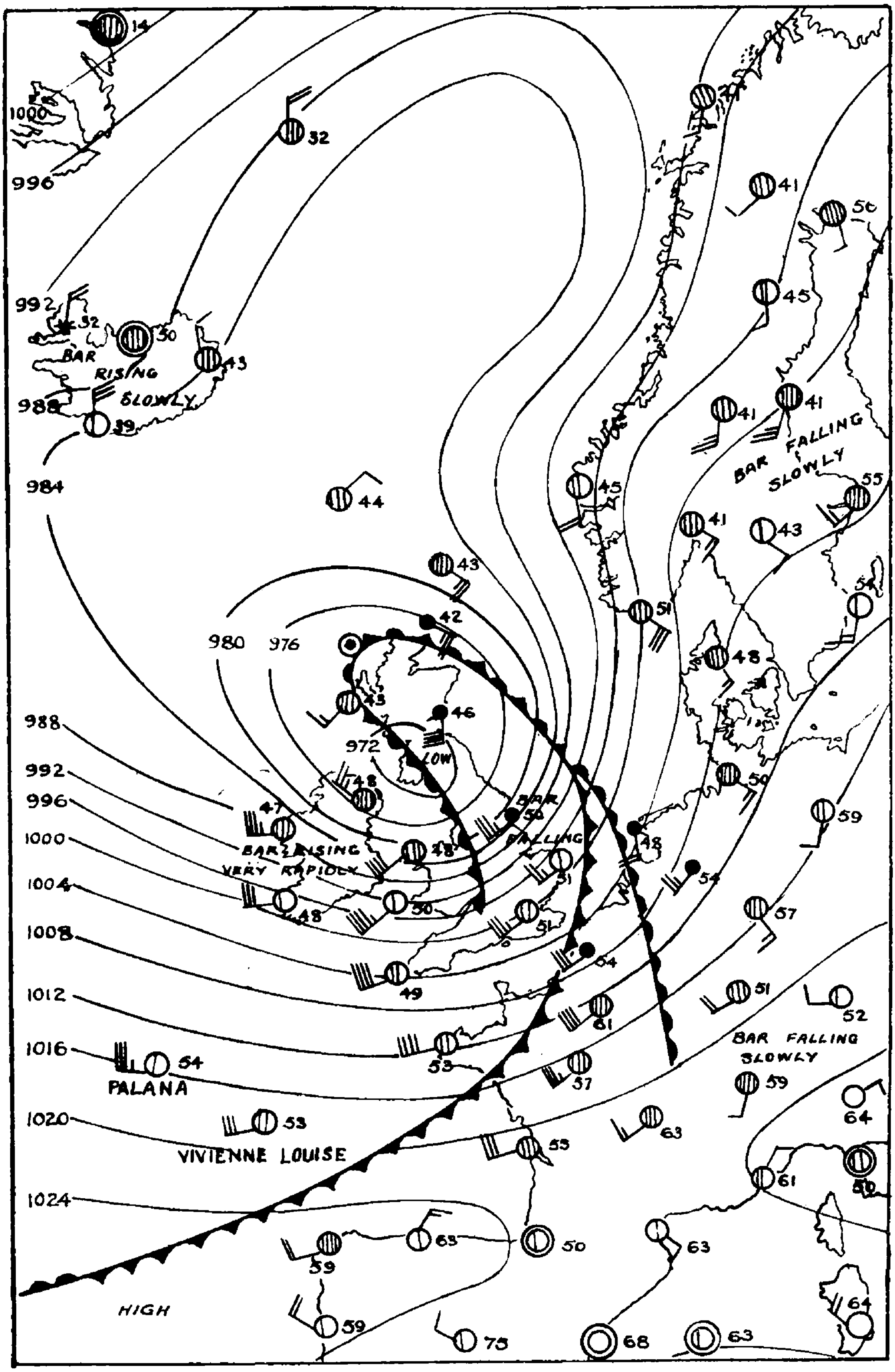


Fig. 4. Synoptic Chart for 1800 G.M.T. on 23rd April, 1947

By 1800 (see Fig. 4) the depression was centred over SW Scotland and was filling up, the pressure at the centre having risen to 972 mb. The pressure gradient to the S and E of the centre was still very steep ; Pembroke reporting a wind SW force 9.

The gales persisted in the Irish Sea area up to midnight, but by 0600 on the 24th, the wind had moderated, the area of severe gales having moved to the southern North Sea.

Fastnet Rock Lighthouse (51° 23'N., 9° 36'W.). Lies 9 miles ESE of Mizen Head on the south coast of Eire. The base of the old lighthouse can clearly be seen

STRANGE MOONRISE IN THE ANTARCTIC

BY H. H. LAMB, B.A.

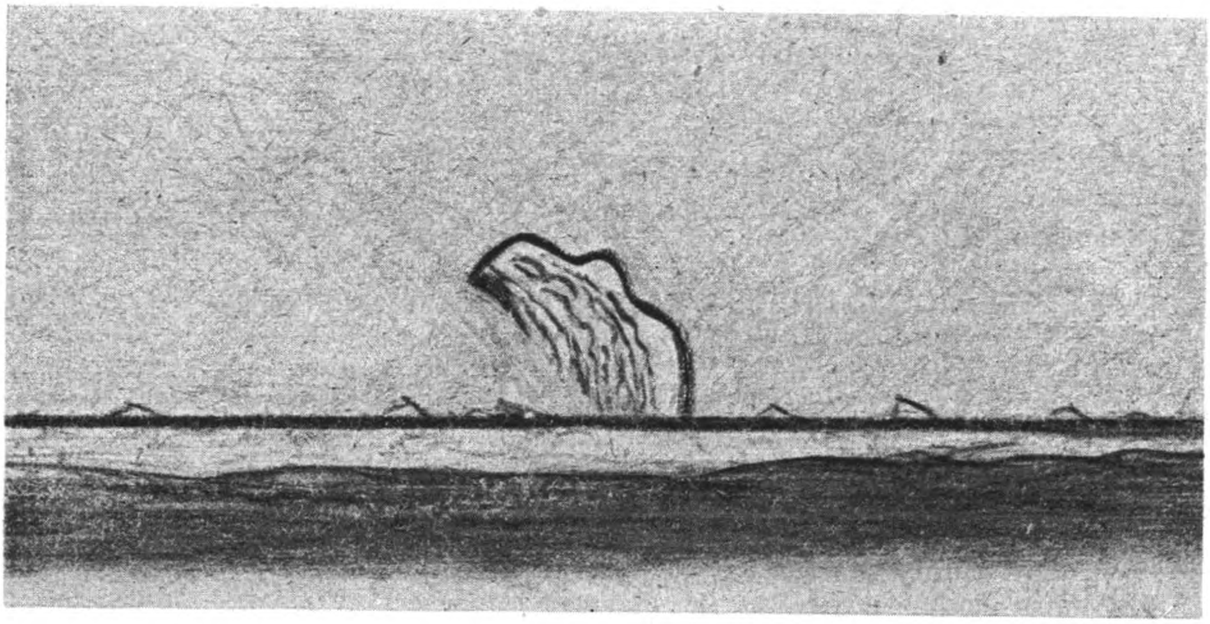
Mirages are common in Antarctic waters near the ice edge, where the thermal contrasts between the ice (and the air over it) and the open water may be great. The sea horizon itself is often distorted, and icebergs and vessels near the horizon commonly seem to be floating in the sky just above the true horizon. Sometimes the horizon line is double : this may be embarrassing when using the sextant to take sights on celestial bodies.

Radiation cooling affects the ice in about the same way as land where the ground cools to give frosts on clear nights in high latitudes ; and on a fine day in summer the sun must be able to warm the ice surface very considerably. On the other hand, the water temperature responds very little, if at all, in high latitudes to the alternate heating and cooling influences of day and night. This means that the contrasts in air temperature over the ice and open water increase from near dusk until the early part of the following day after the sun is up, and then decrease again to become least some time after midday. Mirages are most often seen between dusk and the forenoon of the following day.

Very curious effects may occasionally be seen at sunrise and sunset, moonrise and moonset. And, if the distortion caused by abnormal refraction be great or if the sun or moon rise on a very slanting angle, the unusual phenomena accompanying the rising or setting of these heavenly bodies may be prolonged.

The Antarctic whaling voyage of the whaling-factory ship *Balaena* in the Indian Ocean and Australian sectors to a point off Wilkes Land afforded many opportunities of observing mirages, but the strangest of all was the lingering moonrise of 15th March, 1947, in 64°S 106°E.

The weather was fine and clear. The air temperature measured at the ship, a mile or two from the edge of the pack-ice, was 20° F. and the sea



Moonrise above ice-fields on 15th March, 1947 (64°S., 106°E.)

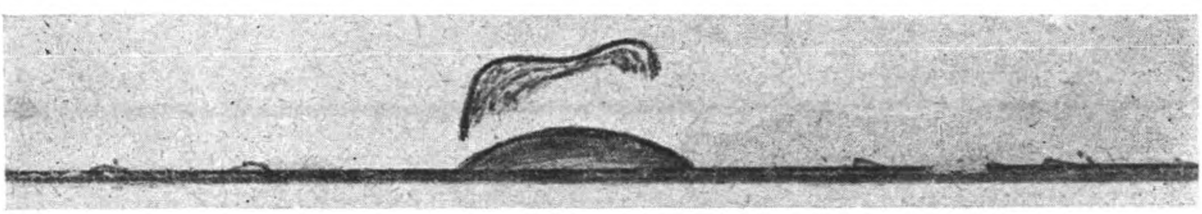
temperature was 28·7° F. There was a SW'ly breeze of force 4 to 5.

At 6.39 p.m., local mean time (1135 G.M.T.), about the time of sunset, as the wastes of ice and water to the eastward were sinking into the grey shadow of the dusk, my attention was caught by what seemed to be a very large iceberg, far off to the south-east, catching the last rays of sunshine with a bright, rose-pink glow. A few minutes later I was surprised to notice that the bright object, which still resembled an iceberg with a steep cliff on one side, seemed to have got rather bigger than I had at first thought it to be. I then had a meal and next came out about half an hour later, when the sun had actually set. I was surprised to see that the supposed sunlit iceberg was still in view. It had not disappeared into the growing dusk, but had grown into a great irregular curtain of rose-pink light. There was a sloping, rather knobbly, upper surface giving a hard, well-defined outline, and from this a bright drapery hung down to end in an irregular fringe reminiscent of Chinese curtains just above the horizon, except at the right-hand side, where the luminous object still had a more solid appearance as of ice or rock and could be seen to reach down to the horizon or beyond. The whole phenomenon was still quite unrecognisable, and as the previous evenings had been cloudy the possibility that I was witnessing the rising moon did not occur to me. By this time there were quite a few interested observers watching, and the suggested explanations were many and varied. They ranged from comets and meteorites to an atomic bomb.

About 7.19 p.m. (1215 G.M.T.) the Chief Officer gave it as his opinion, based on experience of more seasons in the Antarctic than the other onlookers, that it was the moon we were watching. This suggestion did not convince anybody else present, until about 10 minutes later, the changing shape, which had become too large for any other source of light to be acceptable as an explanation, began to resolve itself into a recognisable half-moon.

Not until nearly 7.49 p.m. (1245 G.M.T.), 1 hour and 10 minutes after its first appearance, was the moon clearly above the horizon and undistorted. The elevation of its lower limb was by this time about 1 diameter (approximately 30′ of arc) above the apparent horizon. The horizon itself may well have been affected by the peculiar optical conditions prevailing.

All the next day, 16th March, 1947, great refraction abnormalities continued to affect distant objects seen near the horizon, which was often double. The sun was greatly distorted at sunset on that day, being accompanied during the last minute or so before it disappeared by a greenish-yellow drapery immediately above the orb, and of a shape reminiscent of the rising moon on the 15th. This greenish-yellow curtain of light set below the horizon a few minutes after the sun.



Sunset with drapery on 16th March, 1947 (64°S., 105°E.)

Editorial Note.—The computed altitudes of the moon about this time may be of interest. The table below gives the true altitude of the centre of the moon's disc between 1100 and 1300 G.M.T. and the apparent altitude of the upper limb after corrections have been applied for semi-diameter (+14·3′) and parallax (−54·3′), together with a normal correction for refraction, say +33′. Refraction seems to have been far from normal, but it is apparent that the moon was near its lower culmination, in the south, and was then moving almost parallel to the horizon.

G.M.T.	True altitude of centre of disc	Apparent altitude of upper rim
1100	+0° 14′	+0° 7′
1130	+0° 00′	−0° 7′
1200	+0° 07′	0° 0′
1230	+0° 34′	+0° 27′
1300	+1° 26′	+1° 19′

The latitude was about 64° 17′S, and the declination of the moon about 25° 42′S so that the sum of the declination and latitude came to almost exactly a right angle. When this condition is fulfilled, the true position of the centre of the moon's disc just touches the true horizon at lower culmination. On the other hand, if the latitude and declination were of opposite signs, one N and one S, but their absolute values totalled 90°, the true position of the centre of the moon's disc would then just touch the true horizon at upper culmination.

The same considerations hold, of course, for the sun, and this suggests the possibility of some interesting observations. If the latitude, declination of the sun, semi-diameter and refraction are such as to cause a protracted sunrise or sunset, or if the sun just fails to set or just shows its upper rim over the horizon, the green flash may be prolonged so as to be visible for a considerable period. During Byrd's Antarctic expedition the green flash was thus seen for 35 minutes, when the sun, rising for the first time after the polar night, was moving almost parallel to the horizon.

OBSERVING WEATHER AT SEA

(II) Sea Surface Temperature

BY T. H. KIRK, B.SC.

The observation of sea surface temperature is a very important one. On it depends our knowledge of the heat exchange between atmosphere and ocean, and hence of the modifying processes that take place in air masses moving over the sea. In particular it is an essential observation in the forecasting of fog and cloud.

In the title of this article " sea *surface* temperature " has been purposely substituted for the more usual " sea temperature " in order to emphasise that the meteorologist, having in mind his problems of heat exchange, is primarily interested in the temperature of the sea *at the surface*. To the ship's engineer sea temperature means the temperature of the water that is drawn into the ship to cool the engines. This water is normally taken from a depth of 10 to 20 ft. and hence without further evidence and examination cannot be regarded as representative of the surface. It would appear likely, however, that on occasions when an appreciable sea disturbance exists, sufficient mixing takes place to ensure a constant temperature in the first 20 ft. or so of depth. In this case the intake temperature could be regarded as representative, provided that there was no heating effect due to the passage of the water through the ship, and that the thermometer was sufficiently accurate.

At present the standard method of measuring sea surface temperature is to draw a sample of sea water in a canvas bucket, taking precautions to ensure that a fair sample is obtained, and that the change of temperature of the water after leaving the sea is reduced to a minimum. A fair sample can only be obtained when the ship is moving and when the bucket is thrown forward of all ejection pipes. Otherwise effluence from the ship gives a false reading. On leaving the sea, the bucket of sea water begins to change its temperature for two main reasons :—

(*a*) heat exchange with the air, including the processes of radiation, convection and conduction. The effect may be either cooling (the more usual effect) or heating.

(*b*) Evaporation, which always involves cooling.

The following procedure is designed to ensure satisfactory results by minimising as much as possible the time interval between drawing the water and reading its temperature :—

(i) Throw the bucket well forward of all ejection pipes.

(ii) If there seems to be a great difference between sea and air temperature, keep the bucket in the sea long enough to ensure that it assumes the same temperature as the water.

(iii) Draw the water as quickly as possible and place the thermometer in the bucket immediately, keeping the water well stirred by moving the thermometer about. It is preferable to move the thermometer up and down, so as to change the water in the reservoir surrounding the bulb as much as possible.

(iv) Read the thermometer after it has been in the water about 30 seconds. In doing this it is preferable to lift the bucket to eye level, or to rest it on the rail with one hand, steadying the thermometer with the other hand while taking a reading. In this case the thermometer will not be taken out of the water. If, however, it is found necessary to take the thermometer out of the bucket for reading, care should be taken to see that none of the water in the reservoir is split, so that the thermometer bulb remains immersed.

(v) Hang the canvas bucket upside down to ensure its draining properly and keep it and the thermometer in a shaded place when not in use.

The canvas bucket method has been in use for many years. Only in recent years has much attention been given to the possibilities of error due to heat exchange and evaporation. The use of canvas is open to objection, for being of a porous nature the evaporative effect is enhanced. It was originally used, no doubt, because ships provided their own buckets and canvas was a material common on all ships. Canvas buckets are reasonably durable when compared with metal ones which, although of superior performance, cannot withstand the buffeting against the ship's side. The standard bucket at present in use on British ships is provided with a spring lid. This serves the dual purpose of diminishing evaporation from the surface of the water, and of preventing spilling when the bucket is being hauled in. Experiments are being made with a new type of insulated bucket.

The thermometer at present in use was originally designed with a metal reservoir, the idea being that the thermometer could be taken out of the water, the bulb remaining immersed in the water held by the reservoir. Experience shows that it is very desirable to keep the thermometer immersed in the water in the bucket.

On large and fast ships it is difficult to take a sample of water with a bucket. The difficulty becomes greater in rough weather, when the operation may become dangerous to an unskilled observer owing to the considerable risk of being pulled overboard. For these reasons there is a growing tendency among meteorological services to install sea thermographs, which give a continuous record of temperature at intake depth. The sea thermograph consists of a temperature element which is inserted in a pocket in the intake pipe on the inboard side of the main valve. The temperature element is attached to a distant recording mechanism which provides a continuous record either in the engine room or in the chart room.

For reasons of economy this method can only be used in a relatively small number of ships. The cruder method of reading the temperature of the intake water in the engine room, either by means of a fixed thermometer or by measuring the temperature of water drawn from a stopcock, is of course available on all ships. Experience shows, however, that comparable results cannot be obtained in the absence of standardised equipment. In view of this, and bearing in mind the necessity of a measurement of sea temperature at the surface instead of at a variable depth, it appears that the bucket method, in spite of its disadvantages, must remain the standard one.

PERSONNEL

The Marine Superintendent will be glad to receive information of distinctions gained and retirements, etc., of Marine Observers.

RETIREMENT.—COMMODORE SIR JAMES GORDON BISSET, C.B.E., R.D., R.N.R., LL.D., has recently retired from the service of the Cunard White Star, Ltd.

Born at Liverpool in 1883, Bisset went to sea as an apprentice at the age of 15 in the barque *County of Pembroke*, and served in her until 1903 when he joined the full-rigged ship *County of Cardigan* as 2nd Mate. In 1905, on passing for 1st Mate, he left sail for steam, and after serving with various companies joined the Cunard Line as 4th Officer, with an Extra Masters' Certificate in 1907.

Commissioned as Sub-Lieutenant, R.N.R., in 1910, Lieutenant Bisset did his years' training from May 1913 to May 1914 in H.M.S. *Suffolk, Princess Royal* and *Syren*. After the outbreak of war he saw service in the armed merchant cruiser *Caronia* and in the *Mauretania*, later taking command of H.M.T.B.D. *Robuck*, a command which he held for 3 years until the end of the war.

Commodore Sir James Gordon Bisset

Returning to the Cunard White Star Line in 1919, he served as 1st Officer, later in 1926, becoming Chief Officer under the command of Captain Melsom. 1927 saw him as Staff Captain of the *Berengaria* and later of the *Aquitania*. In May, 1931 Captain Bisset was officially appointed Captain in the company's service and given command of the *Aurania* in the Canadian trade.

On 3rd September, 1939, at the outbreak of the last war, Captain Bisset was in Boston in the *Franconia*, in which ship he steamed 12,000 miles and carried some 30,000 troops round the Cape to the Middle East, finally leaving her at Trinidad in 1942 to relieve Captain John Townley in the *Queen Mary* at Key West on 22nd February. From this time until the end of the war he was engaged on trooping, carrying some 600,000 troops.

Captain Bisset was promoted to Commodore of the Cunard White Star fleet in January, 1945, and received his knighthood on 10th July. In August he joined the *Queen Elizabeth* at the Clyde, holding this command until his retirement on 8th January, 1947.

Among the many honours Sir James received is the award of Honorary Doctorate of Laws (LL.D.) at Cambridge on 31st January, 1946. His role in rescuing part of the crew of *Usworth* in mid-Atlantic in 1934 was recognised by the award of the Lloyds Medal, the Liverpool Shipwreck Society Medal and the New York Life-saving Benevolent Society Medal, among others.

During his career many famous people have journeyed under his protection, noteworthy among them being Mr. Churchill, who has crossed the Atlantic three times with Sir James in command. Others include the highest representatives of the different realms of politics, religion, art and screen.

Marine Observers will join with the Marine Branch in wishing Sir James health and happiness in his well-earned retirement.

J. H.

"AIRMET" BROADCASTS

These broadcasts are issued hourly each day from the Meteorological Office Forecasting Station at Dunstable. They are transmitted by Borough Hill radio station on 245 kc/s. (1,224 metres), at each hour, from 0710 to 1810 G.M.T. (0610 to 2110 G.M.T. during British Summer Time).

Although issued for the use of aircraft, the broadcasts may be of value to shipping in coastal waters of the British Isles.

The general meteorological situation over the British Isles and the neighbouring Continent is discussed each hour, the forecaster describing the pressure and frontal distribution at the time, and the nature of the developments expected in the future.

Reports of existing weather conditions at a number of aerodromes are included in the broadcast. A list of these reporting stations is given below, and the accompanying chart shows their positions. Many of these stations are situated on or near the coast, and their hourly reports may be of considerable interest to coastal shipping.

Details of the broadcasts are as follows :—

R/T Transmissions

Time : 0710–1810 hourly. (0610–2110 during British Summer Time.)

Form of Message : Commencing "Airmet", message is in parts as follows :—

PART I (at 10 minutes past hour). General meteorological situation in relation to conditions expected over British Isles and neighbouring Continent, followed by meteorological warnings.

PART II (at 20 minutes past hour). Existing weather and expected changes.

PART III (at 30 minutes past hour). Weather reports from about 40 selected aerodromes.

PART IV (at 40 minutes past hour). Repetition, with modification, of Part II.

PART V (at 50 minutes past hour). Supplementary reports from aerodromes.

Note.—Reports referred to in Parts III and V are selected from the following list :—

Station	*Lat.* ° ′	*Long.* ° ′	*Station*	*Lat.* ° ′	*Long.* ° ′
Croydon	51 21N	0 07W	Valley	53 15N	4 32W
Heath Row	51 28N	0 27W	Liverpool (Speke)	53 21N	2 53W
Northolt	51 33N	0 25W	Ringway	53 21N	2 16W
Hendon	51 36N	0 14W	Cottesmore	52 43N	3 38W
Lympne	51 05N	1 01E	Langham	52 56N	0 58E
Tangmere	50 51N	0 43W	Waddington	53 10N	0 31W
Hurn	50 47N	1 50W	Leeming	54 18N	1 32W
Poole	50 43N	1 57W	Jurby	54 21N	4 30W
Guernsey	49 26N	2 36W	Aldergrove	54 35N	6 13W
Jersey	49 12N	2 12W	Castle Archdale	54 28N	7 43W
Predannack	50 00N	5 14W	Acklington	55 18N	1 39W
Scilly	49 56N	6 18W	Renfrew	55 52N	4 24W
St. Eval	50 28N	4 59W	Prestwick	55 31N	4 36W
Fairwood	51 38N	3 58W	Leuchars	56 23N	2 53W
Bristol	51 25N	2 35W	Aberdeen (Dyce)	57 12N	2 12W
Lyneham	51 30N	1 59W	Tiree	56 29N	6 52W
Membury	51 29N	1 34W	Benbecula	57 28N	7 22W
Blackbush	51 19N	0 51W	Stornoway	58 13N	6 20W
Woodbridge	52 05N	1 24E	Wick	58 27N	3 05W
Bassingbourn	52 06N	0 03W	Paris	48 57N	2 18E
Oakington	52 16N	0 03E	Amsterdam	52 19N	4 47E
Honiley	52 22N	1 42W	Brussels	50 48N	4 21E

Chart showing positions of aerodromes referred to in "Airmet" broadcasts

SOUTHERN ICE REPORTS

During the Years 1945 and 1946—December

Year	Day	Position: Latitude	Position: Longitude	Description	Remarks	Name of Ship Reporting
		° ′	° ′			
1945	4	From 56 54S	33 48W	Pack Ice	Scattered	*Southern Venturer*
		To 56 30S	33 12W			
	5	From 55 24S	33 24W		Stopped during night to leeward of Ice Pack	
		To 55 06S	33 12W			
	7	From 54 54S	32 00W	Some bergs	Steaming slow along Ice Pack	
		To 54 12S	32 00W			
	8	From 53 54S	31 24W	Some large bergs	Steaming slow outside of Ice Pack	
		To 53 48S	30 42W			
	10	From 54 12S	27 36W		Vessel stopped and drifting fishing grounds. Engines used to keep clear of Icebergs	
		To 54 48S	28 00W			
1946	1	56 05 S	28 05 W	Bergs		*Southern Harvester*
		56 00 S	27 05 W	Bergs		
	2	56 08 S	27 00 W	Bergs		
		57 00 S	25 00 W	Bergs		
		57 10 S	25 05 W	Bergs		
		57 15 S	24 00 W	Bergs		
	3	57 38 S	24 12 W	Bergs		
		57 25 S	23 00 W	Bergs		
		58 40 S	23 07 W	Bergs		
		59 04 S	23 37 W	Bergs		
	4	59 12 S	23 50 W	Bergs		
		59 10 S	23 45 W	Bergs		
	5	From 58 54 S	23 00 W	Bergs observed approximately every 2 miles to the north of a line joining these 2 positions, and bergs, growlers and pack-ice to the southward of the line.		
	7	To 58 00 S	17 33 W			
	10	57 00 S	10 07 W	Berg with several to SSE	Berg at position given was approximately 6 miles by 2 miles in size. Berg at position given was passed approximately 3 miles off and by sextant angle gave a height of 150 ft.	
	14	58 28 S	9 32 W	Bergs and growlers around position. Pack ice.	Believed to be approximately 20 miles inside of edge of pack ice.	
	18	58 46 S	7 14 W	Bergs of various sizes in vicinity of position.		
	19	From 58 50 S	6 35 W	Bergs and growlers observed either side of a line joining these 2 positions.		
	20	To 58 50 S	5 54 W			
	22	58 24 S	7 08 W	Bergs and growlers in vicinity of position at varying distances.		
	23	58 28 S	8 15 W	Bergs, growlers and open pack ice.		
	24	From 59 00 S	9 56 W	Several large bergs and growlers in vicinity and to noon position on 27th inst.		
	27	To 59 02 S	10 41 W			
	28	58 44 S	10 46 W	Several large bergs in vicinity.		
	29	58 35 S	10 33 W	Several large bergs in vicinity.		
	31	58 40 S	12 19 W	Several large bergs in vicinity.		

October and November, 1945 : No reports received.
October and November, 1946 : No reports received.

Reports of ice previous to October, November and December, 1945, will be found in *The Marine Observer*, Vol. XVI, No. 136, page 157.

INDEX

FLEET LIST
VOLUNTARY OBSERVING SHIPS

The following is a list of British regular observing ships, voluntarily co-operating with the Marine Division of the Meteorological Office.

The names of the Captains, Observing Officers, and Senior Radio Officers are given as ascertained from the last written return received. The date of receipt of the last return received is given in the sixth column.

All returns received from observing ships will be acknowledged, direct to the ship, by the Marine Superintendent.

The Port Meteorological Officers and Merchant Navy Agents at the ports will make personal calls on the Captains and Observing Officers as opportunity offers, or on notification from the ship at any time when their services are desired. (See under Notices to Marine Observers).

Excellent awards will be made at the end of the financial year. The names of the Captains, Principal Observing Officers and Senior Radio Officers gaining these awards will be published in a special list in the *Marine Observer*.

It is requested that prior notification of changes of service, probable periods of lay up, transfer of Captains, or other circumstances which may prevent the continuance of voluntary meteorological service at sea, may be made to the appropriate Port Meteorological Officer or Merchant Navy Agent.

Captains are requested to point out any errors or omissions which may occur in the list.

Name of Vessel	Captain	Observing Officers	Senior Radio Officer	Owners	Last Return Received
Admiral Sir John Lawford	W. B. Hicks			Iago Steam Trawler Co., Ltd.	
Afghanistan	T. H. Farrar, O.B.E.	R. L. Cain, J. Linton, R. S. J. Collins	V. D. Slevin	F. C. Strick & Co., Ltd.	29.8.47
Ajax	C. H. Whitehouse	I. Mck. Jackson, D. L. Emery, C. M. Best	F. G. Short	A. Holt & Co.	12.6.47
Akaroa	W. J. Williams			Shaw, Savill & Albion Co.	
Albion Star	F. N. Johnson	A. S. Wood, A. K. White, H. D. Windle		Blue Star Line, Ltd.	23.6.47
Alcantara	H. Way	A. Barff, D. R. Bryden, T. P. Devlin, I. Jamieson	R. E. Hammond	Royal Mail Lines, Ltd.	26.7.47
Alpha Zambesi	J. Forsythe			Alpha S.A., S.S. Co., Ltd.	
Amastra	A. K. Bamberry	J. Kell, J. McKay, J. Weatherley	J. Evans	Anglo-Saxon Petroleum Co., Ltd.	18.8.47
Amersham	A. Spence	E. S. Ward, W. P. Tait	W. C. Sheard	The Thompson Steamshipping Co., Ltd.	18.7.47
Aquitania	G. E. Cove	D. Robertson, E. Stark, J. B. Mort, L. Givan	G. Parsons	Cunard White Star Line, Ltd.	24.8.47
Arabistan	J. H. Metcalfe	W. G. Smith	F. Fawcett	F. C. Strick & Co., Ltd.	1.5.47
Araby	H. P. Taggart	G. A. Keen		Royal Mail Lines, Ltd.	
Arakaka	D. R. C. Onslow	J. A. Carter, S. Armitage, G. Burke	P. Taylor	Booker Bros., McConnell & Co., Ltd.	19.6.47
Arctic Ranger	J. W. Hamling	J. W. Hamling	J. Milne	Boyd Line, Ltd.	5.11.46
Argyll	J. Dodds			B. J. Sutherland & Co., Ltd.	
Ariguani	J. A. Wallis, D.S.C.	J. Beatson, W. F. Young	A. N. Taylor	Elders & Fyffes, Ltd.	21.6.47
Artisan	H. Coates	M. W. Lawson-Smith		T. & J. Harrison	30.4.47
Arundel Castle	L. P. Wilkie	Taylor, Rutherford, Fancourt	Williams	The Union Castle Mail S.S. Co., Ltd.	2.4.47
Ascania	R. Sell, R.D., R.N.R.	J. Hughes, G. Drinkwater, H. Huntley	S. K. Alston	Cunard White Star Line, Ltd.	17.4.47
Asia	J. A. Myles, R.D., Cdr., R.N.R.	E. A. Irvine		Cunard White Star Line, Ltd.	
Asturias	B. K. Berry, R.D., R.N.R.			Royal Mail Lines, Ltd.	
Athelchief	A. W. Pegg	R. C. Stone, J. A. Russell, B. Walker	G. Clark	Tankers, Ltd.	2.8.47
Athelprince	H. J. Hill	W. O. Williams, C. C. Billson, R. McGregor	A. E. Morton	Athel Line, Ltd.	17.1.47
Athelregent	W. Meneight	S. Barbour, D. Waite, R. Gray, C. Ferguson	N. Martin	Athel Line, Ltd.	22.8.47
Athlone Castle	W. D. Roach	J. K. Mumford, J. A. Scott, G. B. Murray		The Union Castle Mail S.S. Co., Ltd.	
Atlantis	D. R. Lee	L. H. Paine, J. Gulliford, R. Phillips, W. T. Smith	L. G. Hoskins	Royal Mail Lines, Ltd.	10.6.47
Auricula	H. Sangster	J. M. Powell, F. H. Walton, R. W. Moreton	T. G. Coughlan	Anglo-Saxon Petroleum Co., Ltd.	18.8.47
Australia Star	O. C. Roberts	J. Hliwa, D. Carstairs, J. Thomas	R. C. Rollason	Blue Star Line, Ltd.	21.8.47
Australind	J. F. Woods	D. R. G. Stephen, R. Thomson, N. H. Smith	S. Hall	Trinder, Anderson & Co.	11.8.47
Balantia	F. A. C. Thacker	B. Y. Harrison, G. Fraser, J. Chester	H. Davies	Royal Mail Lines, Ltd.	15.7.47
Banff Park	E. Bursby	T. Burke, G. Dunn, R. Rutherford	J. Spicer	Ohlson Steamship Co., Ltd.	27.5.47
Barjama	M. Frazer	I. Ferguson, J. Green, W. Flett		Charles R. Mauritzen	19.6.47
Baron Napier	J. H. Anderson	W. C. Casson, J. G. Bowman, K. Krutainis	H. Carter	H. Hogarth & Sons	17.7.47
Baskerville	E. Pugh, O.B.E.	E. A. Tickner, W. McClean, F. B. Jones	P. Kelly	Runciman (London), Ltd.	21.8.47
Bassano	G. Hodgson	P. R. Skelton, B. W. Waldie, N. O. Cook	G. H. Shilson	Ellermans Wilson Line, Ltd.	21.7.47
Beaverburn	J. B. Smith, O.B.E.	S. Fieldhouse, J. B. Laflin, A. Aikman	T. Ainsworth	Canadian Pacific S.S., Ltd.	11.7.47
Beaverdell	C. E. Duggan, R.D., Capt., R.N.R.	G. Bateman, L. E. McDowell, D. H. Coughlan	L. Norton	Canadian Pacific S.S., Ltd.	21.7.47
Beaverford	R. A. Leicester, O.B.E.	G. W. R. Graves, E. R. Connorton, E. R. Shaw	W. L. Poingdestre	Canadian Pacific S.S., Ltd.	30.8.47
Beaverglen	J. P. Dobson, D.S.C., R.D., R.N.R.	B. G. Evans, G. M. Ball, W. E. Williams	J. S. Skinner	Canadian Pacific S.S., Ltd.	21.3.47
Beaverlake	C. L. de H. Bell, D.S.C., R.D., R.N.R.	M. Hurd-Wood, R. Walgate, D. Blois	A. R. Humphries	Canadian Pacific S.S., Ltd.	31.7.47
Benedict	A. Allan	A. S. Richardson, H. Gill, J. Gibson	R. M. Stevens	The Booth Steamship Co., Ltd.	10.1.47

Benledi	A. P. Paterson	G. Spears, G. Miller	A. Saltwell	W. Thomson & Co.	30.6.47
Benreoch	J. B. Hastie	J. T. Fyffe, S. Murray, J. Lobban	I. M. Fraser	W. Thomson & Co.	26.6.47
Bibury	A. Roche	A. Jones		Houlder Bros. & Co., Ltd.	
Black Prince	P. F. Owens	V. D. Joames, W. J. Nicholson, J. C. Giles	E. H. Pickering	Rio Cape Line, Ltd.	1.6.47
Bravo	E. Tyler	C. W. Fox		Ellerman's Wilson Line, Ltd.	
Brisbane Star	F. N. Riley, D.S.O.	D. Russel, J. W. Rogers, L. Tessier	J. D. Eastwood	Blue Star Line, Ltd.	22.5.47
British Colonel	E. L. Miller	W. S. Jaeger	R. MacLeod	British Tanker Co., Ltd.	16.4.47
British Commodore	H. T. Jones	E. Shingler, J. Gough	F. Hall	British Tanker Co., Ltd.	17.5.47
British Endurance	W. Watkin-Thomas	L. McRitchie, A. D. Millar	A. E. Adams	British Tanker Co., Ltd.	24.8.47
British Escort	D. F. Ward	T. H. Evans, H. Evans, G. S. Lawson	A. Rankin	British Tanker Co., Ltd.	24.8.47
British Hussar	T. J. Picken			British Tanker Co., Ltd.	
British Lancer	W. S. Vittle	J. A. Picken, W. R. Symon, D. H. Ferrett	C. O'Mahony	British Tanker Co., Ltd.	5.2.47
British Marquis	J. C. Lea, O.B.E.	G. S. Allen, F. Robinson, S. Davies	W. Anderson	British Tanker Co., Ltd.	12.8.47
British Patience	G. A. Dickson	J. H. Jones	L. Cooper	British Tanker Co., Ltd.	20.2.47
British Pilot	R. O. Cash	J. R. Lumley, W. L. Morrison, R. E. Russell	G. Squire	British Tanker Co., Ltd.	10.7.47
British Piper	M. W. Good	H. White, A. Brading, J. Milburn	J. Pearcey	British Tanker Co., Ltd.	19.4.47
British Power	C. Colburn	R. S. Threadkell, N. Leybourne, S. E. Banyard	L. Diffley	British Tanker Co., Ltd.	12.8.47
British Resolution	J. C. Leybourne	T. Dawson		British Tanker Co., Ltd.	25.2.47
British Statesman	J. R. Georgeson			British Tanker Co., Ltd.	
British Swordfish				British Tanker Co., Ltd.	
Brittany	H. A. Wright	J. Fox, J. L. Perkins, M. H. Blackman	A. Oates	Royal Mail Lines, Ltd.	20.6.47
Brockleymoor	D. J. Jones	F. W. Gant, T. Looker	J. Hanrahan	Runciman Shipping Co., Ltd.	25.8.47
Brontes	E. Drinkall			Henrikson & Co.	
Bulby	G. Bull			Seddon Fishing Co., Ltd.	
Cairnavon	A. Henderson	W. McD. Nicholson, G. Percy, S. W. Taylor	E. Johnston	Cairns, Noble & Co.	21.7.47
Cairnesk	I. G. Foster	W. Pargeter, T. Hand, W. Tiffin	Francis	Cairns, Noble & Co.	27.7.47
Cairnvalona	A. Molineaux	J. W. Cuthbertson, G. R. Norvell, T. D. Ridley	O. R. Thomas	Cains, Noble & Co.	30.6.47
Cameronia	J. M. Brown	G. Russell, J. Watson, T. Langlands	D. Thomson	Anchor Line, Ltd.	28.4.47
Cape Barfleur				Hudson Brothers Trawlers, Ltd.	
Cape Gloucester	C. Agerskow	J. Hamilton	J. Hamilton	Hudson Brothers Trawlers, Ltd.	17.6.47
Cape Mariato	W. E. Woodall	W. E. Woodall, R. N. Dixon	R. N. Dixon	Hudson Brothers Trawlers, Ltd.	13.2.47
Cape Trafalgar	R. A. Cook			Hudson Brothers Trawlers, Ltd.	
Cape York	H. S. Todd	G. O. Lambert, D. E. Cormack, I. Thomson	S. Gracie	Lyle Shipping Co., Ltd.	
Capetown Castle	J. C. Brown, C.B.E., R.D., Cdre., R.N.R.	J. V. H. Drummond, R. Miller, F. W. Tudor	J. Gilbart	The Union Castle Mail S.S. Co., Ltd.	14.6.47
Carella	J. Crewdson	H. Butler	H. Butler	J. Marr & Son, Ltd.	14.12.46
Carnarvon Castle	T. W. McAllen	J. C. Whadcoat, T. R. Kendra, R. E. Johnston	W. A. Brown	The Union Castle Mail S.S. Co., Ltd.	24.8.47
Caxton	J. M. Cherry	R. Crawford, J. Wilson, F. Hamilton	E. F. Ware	Runciman (London), Ltd.	17.7.47
Celtic Monarch	J. Keir	E. A. Muir		Monarch Steamship Co., Ltd.	12.3.47
Cerinthus	J. F. Auld			Hadley Shipping Co., Ltd.	
Cheshire	F. C. Brooks	A. R. Moore, P. Saunders, J. K. Finlay	J. E. Usworth	Bibby Line, Ltd.	19.3.47
Chinese Prince	F. S. Thornton, O.B.E.	H. E. Jennings, P. Brentnall, P. Eccles	E. Wearmouth	Prince Line, Ltd.	15.5.47
Chitral	D. G. H. O. Baillie	J. Newland, B. B. Jones, D. Parsons	A. R. Porter	Peninsular & Oriental Steam Nav. Co.	18.4.47
Chupra	M. C. Williams	C. Allerton, J. Wills, W. Hillcoat	R. C. Whiting	British India Steam Nav. Co., Ltd.	14.8.47
City of Auckland	T. Birkett			Ellerman Hall Line, Ltd.	
City of Barcelona	H. G. Williams, O.B.E.	A. M. Bowman, R. G. Lewis, T. Mayo	J. E. Martlieu	Ellerman Hall Line, Ltd.	16.4.47
City of Bristol	T. F. Labey	R. J. Windsor, J. B. Somerville, L. R. Keith	S. Oracie	The City Line, Ltd.	6.6.47
City of Calcutta	W. H. Matheson	T. Lovell, I. McDermid, J. H. Henderson	D. O'Leary	The City Line, Ltd.	
City of Canberra	B. Tibbetts	H. W. Jarrett	C. Kerridge	Ellerman & Bucknall Steamship Co., Ltd.	
City of Capetown	W. S. Coughlan, O.B.E.	H. Lewis, J. L. Robertson, A. H. Davey	D. R. Crombie	Ellerman Hall Line, Ltd.	21.8.47

Name of Vessel	Captain	Observing Officers	Senior Radio Officer	Owners	Last Return Received
City of Carlisle	L. E. Smith, M.B.E.	A. Burnett, C. F. Hunt, E. J. Beaumont	B. G. Magennis	Ellerman & Bucknall Steamship Co., Ltd.	29.6.47
City of Chester	R. Longstaff, D.S.O.	J. B. Lister	J. A. Vallance	Ellerman Hall Line, Ltd.	9.4.47
City of Delhi	A. M. Hamilton	F. Chisholm, D. J. Inglis, J. A. Potter	J. Appleton	The City Line, Ltd.	29.8.47
City of Dieppe	E. G. Chapman	A. G. Willa		Ellerman & Bucknall Steamship Co., Ltd.	
City of Durham	T. H. Speakman	Hughes-Steele		The City Line, Ltd.	
City of Evansville	A. F. Goring	A. Fry, K. Dews, A. Ramsden	W. Lupton	Ellerman Hall Line, Ltd.	23.8.47
City of Exeter	J. I. Andrew	W. Lowe, D. H. Wardlaw, R. Miller, J. W. Morrison	G. S. Creighton	The City Line, Ltd.	24.9.46
City of Hereford	G. A. Ring	W. R. Tinsley		Westcott & Laurance Line, Ltd.	3.5.47
City of Khartoum	J. A. Beynon	F. S. Angers, H. E. Roberts, R. Frame	A. J. Sharland	Ellerman Hall Line, Ltd.	17.6.47
City of Lincoln	H. Spencer, O.B.E., D.S.O.	G. K. Stewart	G. Stirling	Ellerman & Bucknall Steamship Co., Ltd.	5.10.46
City of Lyons	R. L. Stewart	J. Kendall, A. R. Horam, C. B. Powell	W. Roberts	Ellerman Hall Line, Ltd.	10.5.47
City of Paris	H. Percival, O.B.E.			The City Line, Ltd.	
City of Swansea	F. C. Dashley	T. Dickinson, P. Appleton, K. Haslam	J. Mann	Ellerman Hall Line, Ltd.	8.7.47
City of Sydney	J. B. MacLaren	B. Walker, S. Hider, E. Carter	A. Owen	Ellerman Hall Line, Ltd.	12.5.47
City of Windsor	T. G. Mathias	T. Rigg, M. Graham, E. F. Brick	A. C. Macauley	Ellerman & Bucknall Steamship Co., Ltd.	21.6.47
Clan Brodie	W. Vernon Browne			The Clan Line Steamers, Ltd.	
Clan Campbell	J. A. Foster	S. F. Nicolsen, A. G. Beynon, S. K. Young	R. F. Cole	The Clan Line Steamers, Ltd.	23.8.47
Clan Chattan	H. C. Simpson	F. Turton, J. W. Ward, P. W. Howells	J. Shillabeer	The Clan Line Steamers, Ltd.	25.6.47
Clan Chisholm	J. H. Crellin	R. S. Russell, A. G. Allson, N. Wray-Cook	J. A. Gray	The Clan Line Steamers, Ltd.	11.5.47
Clan Farquhar	A. G. Storkey	W. Graham, R. C. McCullock	A. G. Campbell	The Clan Line Steamers, Ltd.	3.3.47
Clan Forbes	H. S. Pengelly	C. Stonehouse, J. West, N. B. Cox	W. H. Saville	The Clan Line Steamers, Ltd.	27.6.47
Clan Macauley	J. D. Mathews, O.B.E.	T. R. Halliday, I. M. Shearer, P. Haines	R. Gooseman	The Clan Line Steamers, Ltd.	13.2.47
Clan Macdonald	H. Cater	J. P. Dunphy, J. Law, D. Milner	G. Martyn	The Clan Line Steamers, Ltd.	13.8.47
Clan Macdougal	R. P. Gayler	R. G. Bagnall, J. A. Baxter, K. A. Sutherland	C. E. Crewe	The Clan Line Steamers, Ltd.	6.3.47
Clan Maclaren	H. J. Anchor, O.B.E., R.D., Cdre., R.N.R.	R. Helme, A. Mair, J. Duff	R. M. Moore	The Clan Line Steamers, Ltd.	29.8.47
Clan Macnair	R. F. Buckley	M. Mallan		The Clan Line Steamers, Ltd.	25.7.47
Clan Macneil	S. F. Carter	A. M. Vaughan, F. C. Doyle	P. B. Healy	The Clan Line Steamers, Ltd.	4.6.47
Clan Macrae	A. G. MacPherson	T. O. Marr, G. S. Gann, P. C. W. Hoblyn	R. W. Mortimore	The Clan Line Steamers, Ltd.	30.8.47
Clan Urquhart	C. C. Parfitt	W. C. Rodger, J. C. Montgomery, T. N. Geesin	A. F. MacIntyre	The Clan Line Steamers, Ltd.	17.6.47
Clotilde	A. Crewdson			Wembley Steam Fishing Co. (Grimsby), Ltd.	
Clydebank	W. Broome, O.B.E.	E. Craig, L. Witheridge, W. Fromant	E. O'Neill	Andrew Weir & Co.	15.4.47
Clydefield	M. E. Friskney	C. S. Owsten	M. Wilson	Hunting & Son, Ltd.	28.8.47
Columbia Star	C. J. W. Jones	C. G. Lea, A. Smith, L. Berridge	A. E. Clark	Blue Star Line, Ltd.	30.6.47
Comanchee	T. Potts	A. E. Hughes, M. Rutherford, M. B. Guthrie	C. Barratt	Anglo-American Oil Co., Ltd.	30.6.47
Comedian	R. Williams	V. F. Harrison, D. O. Percy, E. D. Ashdown	E. Heywood	T. & J. Harrison	12.8.47
Comliebank	W. Mendus	A. J. Whiston, R. Clark, S. J. East	A. H. Elder	Andrew Weir & Co.	21.4.47
Condesa	R. Smiles, O.B.E.	J. Elliott, L. Fifield, W. A. Byers	W. Brewer	Furness, Houlder Argentine Line, Ltd.	10.7.47
Consuelo	F. Barnard, M.B.E.	H. Edwards, H. Riley, R. C. Neesham	D. Withers	Ellerman's Wilson Line, Ltd.	14.7.47
Cornwall	J. W. C. Pring	J. M. James		Federal Steam Nav. Co., Ltd.	
Coulgorm	G. Robinson	O. M. Ridout, C. E. Pain, R. Kirton	T. Daly	Dornoch Shipping Co., Ltd.	30.6.47
Custodian	A. H. Thomppson	C. S. S. Boam, A. P. Sandford	A. J. Long	T. & J. Harrison	22.4.47
Darro	T. Davies	R. Finch, D. Buckle, J. Sutherland	C. T. Ball	Royal Mail Lines, Ltd.	10.7.47

Deebank	B. Rivett	I. McKay, D. Campbell, T. Ridgeway	J. Freeman	Andrew Weir & Co.	28.8.47
Defoe	G. E. Roberts, O.B.E.	A. H. Watson		Lamport & Holt Line, Ltd.	
Delilian	R. McNie	G. B. Manson, A. McFarlane, S. Bryce	F. P. Lawton	The Donaldson Line, Ltd.	
Delius	H. Underhill	R. H. Turner, W. Jones, H. Jones	R. Pryer	Lamport & Hall Line, Ltd.	15.7.47
Denbighshire	W. F. Dark	D. J. Rudland, Hargrave, Painter, Main	H. A. Cox	Glen Line, Ltd.	28.8.47
Deseado	A. Anderson	R. W. Avison, P. J. Reakes, R. J. Kister	W. Sheehan	Royal Mail Lines, Ltd.	6.5.47
Devis	A. Bibby, O.B.E.	H. M. Bunker	L. Brazill	Lamport & Hall Line, Ltd.	20.7.47
Devon	A. Hocken	C. Robinson, E. Allen, S. G. Robinson, J. Meager	A. Williams	Federal Steam Nav. Co., Ltd.	15.7.47
Devonshire	J. E. Cullen, O.B.E.	D. Hine, J. Carr, L. E. Mollen	G. Nutter	Bibby Line, Ltd.	9.4.47
Dilwara	F. L. Sampson, D.S.C.	H. B. Cray, J. A. Bell, E. L. Sleeman	S. J. Taylor	British India Steam Nav. Co., Ltd.	17.7.47
Dorelian	D. MacQueen			The Donaldson Line, Ltd.	
Drina	W. H. Roberts	D. N. G. East, J. Rutter, E. O'Keefe	D. B. Douglas	Royal Mail Lines, Ltd.	21.6.47
Dryden	C. L. Legg	K. Quirk, J. S. Peterkin, J. L. Radcliffe	S. J. Hardman	Lamport & Holt Line, Ltd.	17.7.47
Dunottar Castle	J. Trayner	J. E. Toogood, N. Upham, J. W. Rogers	E. Pitt	The Union-Castle Mail Steamship Co., Ltd.	11.7.47
Dunster Grange	V. Christie	D. T. Parker, R. Neal, A. Mullins	P. B. McNab	Houlder Bros. & Co., Ltd.	27.6.47
Durango	A. R. Osburn	M. Weekes, J. Brennand, W. R. Clow, J. T. Jones	H. Littlecott	Royal Mail Lines, Ltd.	17.7.47
Durban Castle	C. C. Gorringe	W. S. Brown		The Union Castle Mail Steamship Co., Ltd.	
Durham	R. F. Dunning	N. Eyre-Walker, R. W. Mersey, C. S. Single	E. R. Saunders	Federal Steam Nav. Co.	1.6.47
Eastern	C. Underhill			Eastern & Australian Steamship Co., Ltd.	
El Gallo	E. A. Richardson	T. M. Yates		C. T. Bowring & Co., Ltd.	30.8.47
Empire Brent	J. Cook	J. Short		Donaldson Line, Ltd.	
Empire Halladale	E. Stormont, M.B.E.	T. Moodie, J. C. Alexander, R. Crombe	J. Thomson	Anchor Line, Ltd.	21.8.47
Empire Kinsman	A. Richardson			Bullard, King & Co., Ltd.	
Empire MacCullum	E. A. Jenkins	G. Joslin, R. Dootson, W. H. Kirkbride	H. G. Burton	The Hain Steamship Co., Ltd.	8.2.47
Empire MacDermott	J. Bate, O.B.E.	J. E. Taylor, L. Watson	H. Case	The Hain Steamship Co., Ltd.	18.8.47
Empire MacKendrick	P. F. Ewart	A. A. Roberts, H. Smallwood, J. Woodworth	R. A. Bristy	Goulandris Bros., Ltd.	16.6.47
Empire Martaban	E. Longster	G. McGowan, D. B. Butler	T. M. Keddie	Bolton Steam Shipping Co., Ltd.	3.6.47
Empire Pride	A. Beharrel	E. J. Harding, F. M. Hughes, R. Hammond	A. D. E. Blinco	Bibby Line, Ltd.	28.8.47
Empire Star	S. J. Phillips, C.B.E.	R. H. Hall-Soloman, Lt., R.N.R., J. T. Brown, F. P. McGuckin	A. R. Henderson	Blue Star Line	13.5.47
Empire Viceroy	D. C. Hamilton	D. L. Jardine, L. H. King, R. G. McMahon	W. Elmers	Ellerman Lines, Ltd.	29.5.47
Empire Wharfe	C. R. Hodder	G. W. Wootton, D. A. Braid, H. G. Penny	J. J. Durkin	Elders & Fyffes, Ltd.	12.7.47
Empress of Australia	S. Keay	R. W. Savage, E. Bennett	W. Campbell	Canadian Pacific Steamships, Ltd.	21.7.47
Empress of Canada	E. A. Shergold	R. Rawlings, A. Morrison, J. Jeavons	J. Butterworth	Canadian Pacific Steamships, Ltd.	
Empress of Scotland	J. W. Thomas, O.B.E.	P. R. Holton, S. Massy, J. Waling	H. W. Turner	Canadian Pacific Steamships, Ltd.	31.7.47
Epsom	W. L. Clibborn, O.B.E.			Watts, Watts & Co., Ltd.	
Eros	R. C. Vigurs	A. Hall, J. I. Clark, C. P. Turquand	P. McBride	Elders & Fyffes, Ltd.	5.6.47
Esso Glasgow	C. G. Broughton, M.B.E.	J. Arthur, P. L. Hopkins, S. Robinson, P. Chant	C. C. H. Weekes	Anglo-American Oil Co., Ltd.	30.8.47
Ettrickbank	T. Watkins			Andrew Weir & Co.	
Explorer	W. Moore	C. C. Heaton, C. T. Mercer, A. Highet	G. H. McClelland	T. & J. Harrison	25.6.47
Fanad Head	E. W. Black	W. L. Nelson, C. H. Stark, J. Young	T. P. Jones	Head Line	27.2.47
Fantee	A. M. Scobbie	G. H. Griffiths	J. J. Gilmore	Elder Dempster Lines, Ltd.	29.4.47
Fenja	J. W. Least	I. C. MacDonald		Chr. Salveson & Co.	
Ficus	S. Thompson	S. W. Dean, J. R. Johnson, G. D. Davidson	J. C. Kane	Anglo-Saxon Petroleum Co, .Ltd.	21.7.47
Folda	E. Tulloch	L. B. Anderson, L. Robertson		Chr. Salveson & Co.	
Fordsdale	R. G. Ireland	H. G. B. Moss, R. T. Welch	H. S. Knight	Shaw, Savill & Albion Co., Ltd.	12.7.47
Fort Augustus	R. D. Griffiths	W. S. Dockeray, H. Blair, T. Hyslop	R. Ramshaw	Watts, Watts & Co., Ltd.	

Name of Vessel	Captain	Observing Officers	Senior Radio Officer	Owners	Last Return Received
Fort Brandon	A. D. Seybold, M.B.E.	L. Parnell, D. Chandler, V. J. Owen	T. F. G. Twissleton	Houlder Bros. & Co., Ltd.	18.8.47
Fort Cadotte	A. MacKellar, R.D., R.N.R.	K. D. Lamb, G. L. Mitchell, L. W. Coltham	J. F. Reilly	Cunard White Star, Ltd.	13.8.47
Fort Musquarro	J. Francis Drake, O.B.E., R.D., Cdr. R.N.R.	R. G. L. Hunt		Cunard White Star, Ltd.	
Fort Nakasley	A. Cant	T. Greenough	T. A. Harris	J. & J. Denholm, Ltd.	9.5.47
Fort Perrot	W. Armstrong	A. Webb		Headlam & Son	
Fort Steele	C. G. Mallet	J. Mellan, A. McLean	J. Sheridan	Lyle Shipping Co., Ltd.	30.10.46
Fort Ticonderoga	J. Quayle, R.D., Cdr. R.N.R.	B. T. Tallach, J. Killan, C. H. Chandler	G. Parsons	Cunard White Star, Ltd.	28.2.47
Franconia	C. I. Thompson	M. Hehir, M. V. Meardon, H. W. Locke	J. P. Blanchard	Cunard White Star, Ltd.	25.6.47
Georgic	H. Grattridge, O.B.E.	G. Burd, G. J. Needham, P. Pelling	A. G. Hill	Cunard White Star, Ltd.	6.6.47
Geo. W. McKnight	A. S. Robins	E. Tunnicliffe, F. Bridges, A. L. Searle	R. J. Wealthy	Anglo-American Oil Co., Ltd.	17.6.47
Glaucus	T. Bell	J. A. Dougall, G. Brydges, S. Crump	A. Caro	A. Holt & Co.	14.2.47
Glenaffaric	J. L. W. Johnston	W. E. Wilstead, R. B. Tiplady, A. Wilkins, E. Miller	E. Satoor	Glen Line, Ltd.	29.6.47
Glenartney	W. E. Coates	H. L. Gray, D. Main	Z. R. Machett	Glen Line, Ltd.	1.6.47
Glenbank	E. Dibble	J. J. Reed, M. Murphy, I. H. Ferguson	C. H. Ball	Andrew Weir & Co.	7.6.47
Gloucester	P. S. Calcutt	G. Holland, F. O. Sladen, B. Applegate	J. Devlin	Federal Steam Navigation Co., Ltd.	6.2.47
Goth	T. Barcock			Merchants (Fleetwood), Ltd.	
Gothland	D. Sinclair	A. Miller, J. P. Smith	D. Sinclair	Currie Line, Ltd.	
Hartington	G. K. Bell	J. H. Payne, A. G. Laws, R. Gleadow	P. Proctor	J. & C. Harrison, Ltd.	10.6.47
Heather Island	J. Banks			H. T. Scales & Sons, Ltd.	
Helicina	F. T. Vine	E. O. Jones, A. A. Nicol	G. W. Evans	Anglo-Saxon Petroleum Co., Ltd.	6.6.47
Herefordshire	T. G. A. Thomson	J. W. Mackinley, T. C. Williams, T. Cooper	E. W. Greaves	Bibby Line, Ltd.	23.5.47
Highland Brigade	H. D. Hooper, O.B.E.	R. M. Tyson		Royal Mail Lines, Ltd.	
Highland Chieftain	G. A. Bannister	Brooks, Hawkins, Wright	Desboro	Royal Mail Lines, Ltd.	29.1.47
Highland Monarch	D. A. Casey, D.S.O., D.S.C., R.D., Cdr. R.N.R.	E. J. Evans		Royal Mail Lines, Ltd.	
Highland Princess	D. R. Lee	F. N. Dickenson, J. C. Cotton, A. J. Field	F. Goodall	Royal Mail Lines, Ltd.	19.5.47
Highwear	J. S. Mallaby			E. R. Newbiggin, Ltd.	
Hilary	J. W. Binns, O.B.E.	A. G. Frith, M.B.E., G. Wahlberg, A. J. Foster	J. Stuart	The Booth Steamship Co., Ltd.	6.5.47
Historian	C. C. Heaton	G. Davis, D. Jones, W. D. Aitken	W. Watt	T. & J. Harrison	23.6.47
Hopecrown	T. Georgeson	N. Hanson	W. Thomas	Stott, Mann & Fleming, Ltd.	22.4.47
Hopepeak	C. Grindrod	T. MacArthur, J. R. Dixon, R. Lisle	R. Gladden	Stott, Mann & Fleming, Ltd.	23.5.47
Hopestar	J. Davison	F. H. Dufton, J. A. Jeffrey	H. Donald	Stott, Mann & Fleming, Ltd.	28.8.47
Hororata	A. E. Taylor	R. Webster, B. K. Price, P. Jeanes	C. L. Lambe	New Zealand Shipping Co., Ltd.	28.8.47
Horsa	D. Dickson	C. A. Plummer, G. Driscoll		Currie Line, Ltd.	8.3.47
Inishowen Head	W. A. Haddock	N. C. Stark, J. Smythe, R. McKeague	A. J. Cope	Head Line	11.8.47
Inverbank	A. M. Williamson	J. Mitchell, J. A. Jones	W. Chalmers	Andrew Weir & Co.	19.6.47
Jamaica Producer	P. D. Allen, O.B.E.	R. W. Macfarlane, A. Grossland, A. C. Caird	F.C. Brown	Kaye, Son & Co., Ltd.	29.8.47
Jersey City	J. M. Cox	F. J. Johns		Sir W. Reardon Smith & Sons, Ltd.	
Jessmore	A. C. Bailey	C. T. Ringrose, G. F. Attwell, S. H. Coe	F. Jones	Johnston Warren Lines, Ltd.	13.8.47
John Holt	A. Kennedy	S. Burrows, W. L. Harrison, H. Pearce	T. Murdock	John Holt & Co. (Liverpool), Ltd.	28.3.47
Kaipaki	F. Mole	A. E. Searle		New Zealand Shipping Co., Ltd.	
Koipara	T. R. Windus	N. Fraser, D. Ewan, H. Ashcroft	A. T. Hands	New Zealand Shipping Co., Ltd.	18.8.47

Kaituna	R. F. Hollings			New Zealand Shipping Co., Ltd.	
Kelmscott	R. E. Richardson	P. F. Carnochan, J. F. Thompson, J. Hepplewhite	G. Williams	Runciman (London), Ltd.	30.8.47
Kenilworth Castle	G. H. Mayhew	T. Allen, C. A. Hinton, W. N. Mitchell	J. Gillespie	The Union-Castle Mail Steamship Co., Ltd.	9.4.47
Kent	Hopkins	R. G. Hollingdale		Federal Steam Navigation Co., Ltd.	
King Robert	G. Craze	W. Keith, G. Griffiths, P. Kidd	W. Fielding	King Line, Ltd.	8.5.47
King William	A. B. Drever	D. W. Hobday, L. F. Potter	J. Broad	King Line, Ltd.	22.4.47
Kingston Pearl	A. R. Cornish	A. R. Cornish	W. Weaves	Kingston Steam Trawling Co.	12.8.47
Kohistan	W. A. Chappel	A. Baird, C. O. Jones, F. Fiori	E. A. H. Hayward	F. C. Strick & Co., Ltd.	1.7.47
Lacklan	W. H. Willcox	J. I. W. Reid	H. E. Morrison	Socony Vacuum Transport Co., Ltd.	19.3.47
Lady Elsa	W. Parkinson			Jutland Amalgamated Trawlers	
Lagarto	P. L. Hockey		J. R. Pringle	Pacific Steam Navigation Co.	
Lambrook	H. F. McInnes	J. Orr, H. P. Winkle, R. L. Snaith	A. Leader	Galbraith, Pembroke & Co., Ltd.	18.2.47
Lanarkshire	C. E. O'Byrne	F. H. Petherbridge, E. R. Cooper	C. Budge	Turnbull, Martin & Co.	18.2.47
Lancashire	H. Kerbyson	W. H. Malley, R. F. H. Mason, J. W. Q.-K. Harwood	A. Jones	Bibby Line, Ltd.	22.8.47
Largs Bay	A. V. Richardson	G. W. Houchen, W. G. Barron	D. Macrae	Shaw, Savill & Albion Co., Ltd.	18.11.46
Latia	P. G. G. Dove	R. K. Nicholls		Anglo-Saxon Petroleum Co., Ltd.	
Leeds City	J. D. Lloyd	J. R. Patterson, H. O. Parry, G. J. R. Hayes	R. S. Lee	Sir W. Reardon Smith & Sons, Ltd.	31.7.47
Leicester	J. Holwood	J. T. Andrews		Federal Steam Nav. Co., Ltd.	
Levernbank	A. W. France	C. R. Eaddy		Andrew Weir & Co.	
Livorno	E. S. Green	W. H. Hill, A. Hillerby, G. Dinely	C. Pickles	Ellerman's Wilson Line, Ltd.	30.8.47
Llangibby Castle	J. B. McReynolds, D.S.C.	J. S. Fisher		Union Castle Mail Steamship Co., Ltd.	
Lobos	R. H. Sissons	R. G. Twist, P. H. Ray, R. H. Scaiff	F. Murray	Pacific Steam Navigation Co.	16.7.47
Lochmonar	W. W. Lowe	G. B. Medleycott, J. E. Robson, Lt., R.N.R., P. C. T. Davies	J. Coutts	Royal Mail Lines, Ltd.	12.7.47
Loch Ryan	B. C. Dodds, O.B.E.	N. F. Seaton, C. Hartley, L. W. Green	W. T. Lewis	Royal Mail Lines, Ltd.	14.5.47
Lord Gladstone	J. Abuelo	M. M. Turner		Ships Finance & Management Co., Ltd.	
Lord Glentoran	W. J. Leinster	R. M. Hall, T. Templeton, N. P. Knight	S. G. D. Wessels	Head Line	10.6.47
Lord O'Neill	R. A. Ferguson	N. Walsh, R. Coffey	A. H. Campbell	Head Line	6.6.47
Loriga	T. J. Naylor	W. E. Molloy, F. Galstan		Pacific Steam Navigation Co.	
Losada	E. Potter	P. J. Baldwin, G. E. Turner, H. B. Vance	W. L. Parry	Pacific Steam Navigation Co.	2.7.47
Lulworth Hill	J. Reed	J. S. Henderson	J. Henderson	Counties Ship Management Co., Ltd.	13.7.47
Luminous	S. J. Smith	J. Billett		H. E. Moss & Co.	
Macharda	R. A. Penstone	T. H. Wardle, L. J. S. Saxty, J. F. Baker	G. Caddy	T. & J. Brocklebank, Ltd.	4.7.47
Magdapur	A. Hill			T. & J. Brocklebank, Ltd.	13.6.47
Mahanada	L. T. Owen, O.B.E.	P. A. Gunson, L. F. Dodson, J. C. Long	T. Williams	T. & J. Brocklebank, Ltd.	24.8.47
Mahia	J. W. Hart	P. M. Williams, J. Hurst	J. J. Nolan	Shaw, Savill & Albion Co., Ltd.	8.4.47
Mahout	T. C. Eddy	O. Pritchard, G. Sinclair, P. Greenhall	A. E. Weston	T. & J. Brocklebank, Ltd.	27.7.47
Mahsud	R. Humble	A. Briggs, F. J. Watts	H. Fisher	T. & J. Brocklebank, Ltd.	26.7.47
Maihar	J. P. Paisley	H. P. Ackerley, J. P. Pembridge, D. L. des Landes	D. Butterworth	T. & J. Brocklebank, Ltd.	21.7.47
Makalla	J. B. Newman	J. Clarke, A. H. Fawcett, J. H. Moore	A. N. Orum	T. & J. Brocklebank, Ltd.	14.5.47
Malakand	J. Owen	B. T. Day, G. A. Jackson, E. Anderson	J. Caddy	T. & J. Brocklebank, Ltd.	4.7.47
Malancha	A. S. Bain	W. Gibson, D. S. Carter, T. Kemp	B. Smith	T. & J. Brocklebank, Ltd.	17.6.47
Malayan Prince	J. D. Fraser	H. Gates, G. Wilkinson, E. Knaggs	L. Andrews	Rio Cape Line, Ltd.	
Malmo	J. W. Calvert			Ellerman's Wilson Line, Ltd.	
Manchester City	F. L. Osborne	W. P. Lowthian, W. Hine, M. Bewley, B. S. Roberts	W. H. Critchley	Manchester Lines, Ltd.	9.6.47
Manchester Commerce	H. Handcock	P. Bagshaw, W. E. Quirk, P. N. Fielding	G. Barlow	Manchester Lines, Ltd.	20.11.46
Manchester Division	E. W. Espley	J. Jones, A. W. Leyland, H. V. Neilson	T. Parker	Manchester Lines, Ltd.	14.6.47
Manchester Port	F. Downing	J. M. Mann, E. J. Eccles	W. Lecham	Manchester Lines, Ltd.	28.1.47
Manchester Progress	W. H. Downing	A. Cookson, F. Lewis, C. Marchant	J. J. Bourke	Manchester Lines, Ltd.	14.8.47

Name of Vessel	Captain	Observing Officers	Senior Radio Officer	Owners	Last Return Received
Manchester Regiment	F. D. Struss, O.B.E., D.S.C.	J. L. McLaren, D. S. Millard	F. Park	Manchester Lines, Ltd.	23.4.47
Manchester Shipper	J. Barclay			Manchester Lines, Ltd.	
Manchester Trader	E. W. Raper	R. Hoffman, P. Fielding, W. G. Thomas	A. Gavin	Manchester Lines, Ltd.	22.7.47
Mandasor	L. C. Jeans	J. Nuttall, D. Evans, F. P. Attwood	B. Banks	T. & J. Brocklebank, Ltd.	21.8.47
Maplebank	N. P. McLeod	N. P. McLeod	J. B. Anderson	Andrew Weir & Co.	
Margay	E. A. Prentice			Kaye, Son & Co., Ltd.	
Marinda	J. Clarkson	H. C. Coplin	H. C. Coplin	J. Marr & Son, Ltd.	25.10.46
Markhor	W. Hill, O.B.E.	I. A. MacLaren, G. J. Kenyon, R. N. Bonnry	J. Shofield	T. & J. Brocklebank, Ltd.	3.12.46
Marna	R. R. Hume			Chr. Salveson & Co.	
Marsdale	M. Ferguson	H. Jones, J. Tiere, L. Mansell		Kaye, Son & Co., Ltd.	8.11.46
Martand	T. Fox-Lloyd	E. Watkins, J. Jones, Kenyon	G. W. Hazel	T. & J. Brocklebank, Ltd.	20.5.47
Marwarri	H. C. Kinley	P. D. McKenzie, J. M. Raymont, J. B. Gough	R. W. Corbett	T. & J. Brocklebank, Ltd.	10.4.47
Mataroa	G. M. Robertson	P. H. Currie, P. S. P. Yeoman, D. MacCallum	S. O'Neill	Shaw, Savill & Albion Co., Ltd.	28.8.47
Matheran	A. B. Bannatyne, O.B.E.	H. Simpson, J. A. Miller, A. W. Wiltshire	P. Neeson	T. & J. Brocklebank, Ltd.	16.7.47
Matina	R. A. Thorburn	J. Mayo, T. C. Crane, A. Walborn	A. C. Knight	Elders & Fyffes, Ltd.	22.7.47
Mauretania	R. B. G. Woollatt, R.D., R.N.R.	J. R. Lidgey, M. Foster, A. D. Hunt, K. Milburd	F. Clarke	Cunard White Star, Ltd.	
Memling	D. C. Roberts	G. J. Piper, P. Young, J. A. Martin	D. W. Murphy	Lamport & Holt Line, Ltd.	5.6.47
Millais	J. Byrne	A. Corlett, B. Salisbury, G. Stewart	M. Doran	Lamport & Holt Line, Ltd.	18.8.47
Mirror	S. A. Gammon			Cable & Wireless, Ltd.	
Monarch	R. H. J. Wallis	K. H. Joy, A. Hoar, Black-Tuckwell	Smith	Postmaster General	18.7.47
Moveria	J. L. McQueen	P. M. Will, G. Waddell, J. C. Young	R. Halam	The Donaldson Line, Ltd.	25.6.47
Mulbera	T. J. Murphy	T. A. Robinson, D. C. Morrison, J. S. Davies	J. McMinn	British India Steam Nav. Co., Ltd.	28.8.47
Myrtlebank	L. W. Thorne	R. R. Mitchell	H. F. Greenhalgh	Andrew Weir & Co.	4.11.46
Nab Wyke	P. E. Bedford			Merchants (Fleetwood), Ltd.	
Nairnbank	Holbrooke			Andrew Weir & Co.	
Napier Star	E. N. Rhodes			Blue Star Line, Ltd.	
Nascopie	J. Waters		R. Bromley	Hudson's Bay Co.	5.11.46
Naticina	W. D. Speakman	J. E. Gill, E. Palmer, C. B. Davidson	C. D. Grimster	Anglo-Saxon Petroleum Co., Ltd.	28.8.47
Nestor	E. W. Powell	W. A. Clark, J. G. Wilson, J. R. McCarthy	L. Booth	A. Holt & Co.	12.6.47
New Zealand Star	G. Owen, O.B.E., R.D., Cdr., R.N.R.	F. MacQuiston, R. G. Taylor, L.W. Evans	C. J. Carter	Blue Star Line, Ltd.	14.6.47
Norfolk	A. I. Robertson, R.D., Capt., R.N.R.			Federal Steam Nav. Co., Ltd.	
Northumberland	F. Lougheed	R. G. Anderson, R. S. Linly, C. B. Hewett	A. H. Lugar	Federal Steam Navigation Co., Ltd.	12.8.47
Ocean Valley	W. McMellin	J. S. Dalgueno, T. Shields, W. Hodgson	G. Mitchell	Houlder Bros. & Co., Ltd.	14.8.47
Ocean Wanderer	J. Clinton	J. M. Proctor, R. Anderson	E. C. Owen	Bolton Steam Shipping Co., Ltd.	
Orari	F. Pover	J. Mallett, P. L. Kemp, J. van der Straaten	J. C. Matthews	New Zealand Shipping Co., Ltd.	10.6.47
Orbita	W. A. Hearle	A. McLean, J. Kelly, J. Butterworth	W. McCormick	Pacific Steam Navigation Co.	28.8.47
Orduna	J. Williams	B. A. King, J. B. Olsson, E. Pepper	J. R. Kidson	Pacific Steam Navigation Co.	10.7.47
Orion	C. Fox, C.B.E., L.M.	C. K. Knight, J. Farrell, G. S. Willis	W. A. Boon	Orient Steam Navigation Co.	24.8.47
Ormonde	J. E. Goldsworthy	G. R. Grandage, S. Hickman, C. Thomas	R. Oakley	Orient Steam Navigation Co.	9.4.47
Otranto	A. C. G. Hawker, C.B.E.	E. V. Harris, Thomas, J. W. Cook	C. T. Seaton	Orient Steam Navigation Co., Ltd.	20.7.47

Pachesham	G. Lindsay	R. J. Lungley, K. E. Howard, L. Burton	J. Alton	Runciman (London), Ltd.	9.1.47
Pacific Enterprise	M. E. Cogle, O.B.E.	D. M. Morris, Crosthwaite, Cameron	I. A. Waddell	Norfolk & North American Steam Shipping Co., Ltd.	12.8.47
Pacific Exporter	R. E. Holland	Head, Gouldstone, Williams	R. P. McEwan	Norfolk & North American Steam Shipping Co., Ltd.	17.3.47
Pacific Shipper	E. V. Richards	W. E. Thomas, R. Hughes		Furness, Withy & Co., Ltd.	3.6.47
Palacio	M. H. Atkinson	C. A. Ellis, R. M. Lidgate	P. McCarthy	MacAndrews & Co., Ltd.	14.5.47
Palana	F. R. Spurr	G. T. Page, F. R. M. Greasley, W. Vickers	H. Olding	Peninsular & Oriental Steam Nav. Co.	27.7.47
Palomares		F. Szanage		MacAndrews & Co., Ltd.	
Pampas	T. Powell			Royal Mail Lines, Ltd.	
Papanui	E. A. Burton	G. Fulcher, D. Farmer, A. Chapman	P. Broome	New Zealand Shipping Co., Ltd.	17.4.47
Paparoa	E. A. J. Williams	J. K. Ball, R. L. Daniels, A. L. Dales	J. Jessop	New Zealand Shipping Co., Ltd.	12.8.47
Paraguay	P. M. Burrell	G. A. Gibbons, L. Gibson, T. D. Nicholls	D. C. Howell	Royal Mail Lines, Ltd.	5.8.47
Pardo	J. Smith, R.D., R.N.R.	J. Green, R. Kilbey, J. Postill	K. W. Jones	Royal Mail Lines, Ltd.	4.6.47
Parima	J. N. Duncan	R. Hunnisett	C. Townley	Royal Mail Lines, Ltd.	31.1.47
Paringa	C. E. Pollett	W. N. Ede, G. P. Blythe, A. L. Bennett	A. MacBeth	Peninsular & Oriental Steam Nav. Co.	27.7.47
Perthshire	W. R. Roberts	J. Browne, J. G. Smith, I. W. Benne	F. Rayner	Turnbull, Martin & Co.	10.4.47
Pilcomayo	J. S. Wrake, Lt.-Comdr. R.N.R.	P. G. Driver, D. P. Warren, J. Upton	R. Walsh	Royal Mail Lines, Ltd.	12.6.47
Pipriki	A. Hocken	L. Jeffries, H. Bayley, M. Heron	L. Whittington	New Zealand Shipping Co., Ltd.	17.6.47
Planter	J. J. Wallis	J. L. Cule		T. & J. Harrison	
Polar Chief	A. Goodlad			Chr. Salveson & Co.	
Port Chalmers	R. S. Durham, O.B.E., D.S.C.	D. J. B. Blandford, M. Mitchell, P. Thomas	T. Hargrave	Port Line, Ltd.	17.5.47
Port Fairy	D. G. H. Bradley	A. J. Richardson, G. A. Pycroft, H. S. Cran	E. G. Gunner	Port Line, Ltd.	13.7.47
Port Hobart	T. F. Kippings, O.B.E., D.S.C.	A. Braund, J. D. Aitchison, J. Ashburner	B. Evans	Port Line, Ltd.	14.7.47
Port Jackson	T. H. Rigden			Port Line, Ltd.	22.5.47
Port Lincoln	H. H. Smith, O.B.E.	C. Rhodes, R. Silvester, D. Robinson	F. Griffiths	Port Line, Ltd.	29.7.47
Port Macquarrie	E. T. N. Lawrey	A. W. Kinsett, T. S. Paton, P. M. Hudson	H. J. Griffiths	Port Line, Ltd.	8.4.47
Port Phillip	J. G. Lewis	F. M. Barton, E. W. Dalton	J. Macpherson	Port Line, Ltd.	22.2.47
Port Pirie	W. J. Enright, O.B.E., R.D., Cdr., R.N.R.	R. C. Matthews, H. F. Lunn, J. A. Newberry	W. Miller	Port Line, Ltd.	17.7.47
Port Wellington	W. G. Higgs, O.B.E.	E. J. Arnold, J. T. Owen, L. A. H. Sayles	J. S. MacPherson	Port Line, Ltd.	4.7.47
Port Wyndham	H. Steele	W. H. Hopwood, Lawrence, Bell	P. Hobbs	Port Line, Ltd.	2.7.47
Potaro	S. J. G. Hill	T. A. Evans, W. A. Tressider, W. K. West	D. Loveday	Royal Mail Line, Ltd.	13.8.47
Priam	L. W. Kersley	R. A. Hansell, T. G. Nelson, C. H. Jolly	A. C. Evans	A. Holt & Co.	17.5.47
Rakaia	J. S. Oxnard	C. Davies, T. Gibbon, D. Williamson	J. Pell	New Zealand Shipping Co., Ltd.	
Rangitata	G. Kinnell, O.B.E.	H. P. Lunn, M. Drake, W. Peto	E. Stride	New Zealand Shipping Co., Ltd.	19.6.47
Rangitiki	E. Holland, C.B.E.	L. Stewart-Scott, R. Harding, P. Busby	P. Smythe	New Zealand Shipping Co., Ltd.	24.3.47
Recorder	R. F. Longster	G. W. Sigsworth		T. & J. Harrison	2.6.47
Red Charger	R. Nash	C. Noble		Iago Steam Trawler Co., Ltd.	
Red Crusader	B. Rogerson			Iago Steam Trawler Co., Ltd.	
Red Gauntlet	W. B. Hicks			Iago Steam Trawler Co., Ltd.	
Red Knight	E. Littler		R. Green	Iago Steam Trawler Co., Ltd.	
Red Lancer	M. Wright			Iago Steam Trawler Co., Ltd.	
Red Sword	J. Tomlinson			Iago Steam Trawler Co., Ltd.	
Regent Hawk	J. Ward	W. Pinder, G. R. Arthur, F. K. Clare	J. R. Twiddell	Trinidad Leaseholds, Ltd.	27.6.47
Reighton Wyke	C. Whiting		R. Bell	West Dock Steam Fishing Co.	29.3.47
Rembrandt	J. J. Grugan	R. Thompson		Bolton Steam Shipping Co., Ltd.	
Repton	D. Cownie	D. M. Muir, F. L. James, D. Meardon	T. H. Mitchell	Galbraith, Pembroke & Co., Ltd.	5.8.47
Richmond Castle	J. A. Sowden	E. H. F. Hall	R. Santillo	The Union-Castle Mail Steamship Co., Ltd.	3.2.47
Richmond Hill	M. O'Neill	A. Sligsby		Counties Ship Management Co., Ltd.	

Name of Vessel	Captain	Observing Officers	Senior Radio Officer	Owners	Last Return Received
Riebeeck Castle	J. E. R. Wilford, R.N.R.	J. C. Whadcoat		The Union-Castle Mail Steamship Co., Ltd.	
Rimutaka	P. B. Clarke, M.V.O., O.B.E., D.S.C.	F. Williamson, B. Linklater, J. van der Straaten	A. Stenning	Peninsular & Oriental Steam Nav. Co.	30.5.47
Rippingham Grance	L. Bearbank	H. S. Butler, J. Sinclair, D. Craven	J. Scott	Houlder Bros. & Co., Ltd.	4.7.47
Robert F. Hand	E. J. Instone, O.B.E.	A. Cresswell, R. Phillips, J. Rochford	A. W. Toor	Anglo-American Oil Co., Ltd.	29.3.47
Robert Hewett	G. Elliot	H. Wilcock		The Hewett Fishing Co., Ltd.	
Rochester Castle	D. D. MacKenzie	P. E. Carter, N. R. Knowles	T. Peake	The Union-Castle Mail Steamship Co., Ltd.	12.7.47
Roslin Castle	H. L. Holland	R. J. Miller, J. F. Coleman	H. D. Pereth	The Union-Castle Mail Steamship Co., Ltd.	22.8.47
Rowallan Castle	A. C. M. Black, O.B.E.	K. M. Knight, J. D. Cutliffe, R. G. Patterson	T. M. K. Knowles	The Union-Castle Mail Steamship Co., Ltd.	14.6.47
Roxburgh Castle	J. M. Rayner, R.D., R.N.R.	W. B. Fletcher, K. Grant, C. Hutchins	S. P. C. Harden	The Union-Castle Mail Steamship Co., Ltd.	17.7.47
Royal Star	R. White, D.S.C.	T. G. Hughes, L. Thompson, E. J. Jones	E. C. Owen	Blue Star Line, Ltd.	24.7.47
Ruahine	E. A. Lettington	J. Guylor, E. White, J. Mead	J. Poyner	New Zealand Shipping Co., Ltd.	11.3.47
Rutland	W. Thom	J. Pryde	J. Macfarlane	Currie Lines, Ltd.	
Sacramento	J. E. Robinson, M.B.E.	W. White, A. Jackson, A. C. Dick	W. H. Parratt	Ellerman's Wilson Line, Ltd.	8.7.47
St. Crispin	R. A. Cook	L. Hought	L. Hought	St. Andrews Fishing Co.	14.8.47
St. Just	V. A. Buschini	V. A. Buschini		The Hewitt Fishing Co., Ltd.	
St. Loman	A. Robinson	A. Robinson	G. Schofield	Thomas Hamling & Co., Ltd.	17.7.47
St. Nectan	J. Gibbs	J. Gibbs		Thomas Hamling & Co., Ltd.	
Salaverry	A. G. Litherland	S. Ayland, P. D. O'Driscoll, W. Johnston	J. Reid	Pacific Steam Navigation Co.	1.7.47
Saluta	A. Torgeson	R. L. Wood	P. Curson	Chr. Salveson & Co.	
Samanco	D. W. Hutchison	A. Lang, J. A. Greenwood, G. N. Howe	T. D. Dalzell	Pacific Steam Navigation Co.	29.3.47
Samaria	D. W. Sorrell	J. Ormerod, J. Hughes, W. Marshall	E. P. Bishop	Cunard White Star, Ltd.	7.6.47
San Adolfo	E. J. Osborne, M.B.E.	D. L. Newton, A. W. Willis	R. H. Charlton	Eagle Oil & Shipping Co., Ltd.	20.6.47
San Cirilo	T. L. Pearson	J. W. Pratt, G. G. B. Putt, W. Harper	R. Lomas	Eagle Oil and Shipping Co., Ltd.	6.5.47
San Felix	J. B. Macarthy	T. B. Wright, D. Stevenson, J. Mulligan	W. L. Radcliffe	Eagle Oil & Shipping Co., Ltd.	24.6.47
San Velino	H. C. Archer, O.B.E.	J. Dixon, J. Munday, W. D. Hepworth	W. Bryce	Eagle Oil & Shipping Co., Ltd.	18.8.47
San Veronico	A. R. Hicks	R. R. Griffiths, J. R. Stephens, D. C. Fox	A. F. Carpenter	Eagle Oil & Shipping Co., Ltd.	12.4.47
San Vulfrano	W. Wigham	N. P. MacFarlane, T. O. Davies	N. G. McLean	Eagle Oil & Shipping Co., Ltd.	31.7.47
Santander	I. Sutherland	F. J. Leicester, R. K. C. Thomas, R. Russell	T. Hills	Pacific Steam Navigation Co., Ltd.	13.8.47
Sarmiento	M. Armstrong, D.S.O.	A. Powell, D. T. Beamish, J. W. Peck	A. R. Cox	Pacific Steam Navigation Co., Ltd.	5.6.47
Sarpedon	E. W. Berry	A. G. Sturtees, A. G. Hopkins, K. Jones	G. E. Clarke	A. Holt & Co.	20.12.46
Saxon Star	F. B. Brown	J. B. Kennedy, A. H. Marshall, A. G. Smith	P. Snow	Blue Star Line, Ltd.	11.6.47
Scythia	H. Dixon	D. Johnstone, J. Boyce, W. Macartney, F. A. Pain	J. Doyle	Cunard White Star, Ltd.	22.6.47
Silverguava	J. Duncan	J. M. Evans, D. M. Lamont, N. C. Jones	R. Burrow	S. & J. Thompson, Ltd.	29.7.47
Silverlarch	R. G. Tilmouth	V. Strafford, B. Stark, L. Rothwell	H. O'Gorman	S. & J. Thompson, Ltd.	2.7.47
Silveroak	R. H. Woodrow, O.B.E.	H. Harrison, J. H. Crane, K. A. Wise	R. L. Sinclair	S. & J. Thompson, Ltd.	3.6.47
Silversandal	E. Stark	R. O. Darby, P. Hildred, J.McK. Batchen	F. J. Stubbs	S. & J. Thompson, Ltd.	18.7.47
Silverteak	E. L. Tilmouth	A. W. Maconkey		S. & J. Thompson, Ltd.	1.2.47
Silverwalnut	C. Metcalfe		R. Smith	S. & J. Thompson, Ltd.	22.11.46
Socotra	E. R. Bodley, D.S.O.	E. Lowen, H. Bush, J. Knowles	E. T. Beveridge	Peninsular & Orient Steam Nav. Co.	10.3.47
Southern Collins	D. Hunter	W. Spence, J. Short, J. Foster	J. Hurley	Chr. Salveson & Co.	

Southern Opal	J. O. Bowie	G. Govan, J. Flucker	J. Edmond	Chr. Salveson & Co.	16.6.47
Southern Venturer	H. Nilsen	W. P. Jamieson, F. B. Stewart	D. W. Miller	Chr. Salveson & Co.	14.5.47
Sovac	S. F. Living	J. D. Nutter, J. McLellan, P. S. W. Pitt	D. McMurdo	Socony Vacuum Transportation Co., Ltd.	25.1.47
Staffordshire	E. D. Brand	J. C. Priest, J. F. Carr, A. G. Thompson	A. Rodger	Bibby Line, Ltd.	7.7.47
Stancourt	F. H. Wainford	V. O. Sheppard	G. P. Bryson	Stanhope Steamship Co., Ltd.	6.6.47
Stanhall	H. V. Wightman	W. R. Rodger		Stanhope Steamship Co., Ltd.	
Stirlingshire	J. McCrone	A. S. Palethorpe-May, G. A. Winter, A. J. Rutherford	P. Goss	Turnbull, Martin & Co	17.6.47
Stratheden	S. W. S. Dickson			Peninsular & Oriental Steam Nav. Co.	
Strathmore	D. M. Stuart, D.S.C.	Noble	J. Carey	Peninsular & Oriental Steam Nav. Co.	15.5.47
Strathnaver	E. Lee	E. Mortleman-Lewis, R.D., R.N.R., G. E. V. Holmes, J. R. K. Neale, M. G. Wright	J. Ormiston	Peninsular & Oriental Steam Nav. Co.	20.6.47
Suffolk	H. E. Reilly, D.S.C., R.D., R.N.R.	B. E. Evans, A. McKenzie, G. Bevis	J. Hasson	Federal Steam Navigation Co., Ltd.	14.8.47
Suncrest	L. G. Barwell	J. Johnson, J. Collins, P. Tate	G. W. Morris	Crest Shipping Co., Ltd.	26.3.47
Sutherland	R. W. Nicolson	R. Thwaites, A. L. Clemmet, A. Gardner	A. B. Hill	B. J. Sutherland & Co., Ltd.	30.6.47
Swainby	C. Yare	J. Bicknell, J. Whammond, M. Patterson	K. Wright	Sir W. Ropner & Co., Ltd.	21.8.47
Sydney Star	T. S. Hall, O.B.E.	G. C. Smart, A. H. White, J. King	H. Lammas	Blue Star Line, Ltd.	5.8.47
Tactician	A. Robertson	D. Bloom, J. Tooth	W. J. Vine	T. & J. Harrison	18.8.47
Talca	A. Lyall			Pacific Steam Navigation Co., Ltd.	
Tamaroa	S. O. Oswald	H. H. Falkiner, K. M. Brown, A. R. Stephenson	P. Maloney	Shaw, Savill & Albion Co., Ltd.	29.3.47
Tamele	J. J. Smith	P. J. Finan, R. E. Foster	F. Broomfield	Elder, Dempster Line, Ltd.	14.5.47
Taranaki	F. A. Smith	D. S. Upton, J. Collins	E. Haywood	Shaw, Savill & Albion Co., Ltd.	30.4.47
Tarkwa	W. C. Baxter	A. H. Perkins, P. M. Ralston, J. White, O. Rowlands	C. Forbes	Elder, Dempster Lines, Ltd.	20.6.47
Tasso	H. Scarborough	E. Laverack, K. Allen	L. Richardson	Ellerman's Wilson Line, Ltd.	11.12.46
Tekoura	F. Sutton	D. E. Edmonds	D. E. Edmonds	The Hewett Fishing Co., Ltd.	26.2.47
Telemachus	J. F. Webster	A. Rankin, R. H. Masters, F. T. Power, J. D. Murphy	J. C. Wilson	A. Holt & Co.	21.8.47
Temple Inn	S. Lamont	J. Lees		Lambert Bros., Ltd.	
Teviot	W. W. Dovell	D. Hogarth, T. A. Buckney, V. Charles	A. R. H. Wright	Royal Mail Lines, Ltd.	6.7.47
Thamesfield	D. A. Law	T. Shanks, H. Shaw, A. D. Lombard	G. Middleton	Hunting & Son, Ltd.	19.3.47
Tinto	S. H. Bennett, M.B.E.	A. Ledger		Ellerman's Wilson Line, Ltd.	
Tongariro	A. E. Williams	C. Robinson, H. R. Swift, J. E. Millington	G. M. Parsons	New Zealand Shipping Co., Ltd.	
Torr Head	M. Kennedy	S. T. Ross, E. L. Seaton, J. K. McMorran	G. Penketh	Head Line	5.7.47
Trepassey	E. Burden	N. Stone, F. Windsor	R. Kelly	c/o G. W. Henlen, Colonial Office	10.12.46
Tresillian	C. Crouch	R. B. Oliver, G. Potts, W. Cussens	S. Cox	Hain Steamship Co., Ltd.	15.4.47
Trevaylor	W. Agnew, O.B.E.	J. G. Sleight		Hain Steamship Co., Ltd.	
Tweed	C. E. Mason	N. L. Tapp, M. B. Wingate, J. G. Robertson	T. F. Edwards	Royal Mail Lines, Ltd.	12.5.47
Umtali	F. E. J. O'Hea	J. McDermott, A. Gibson, H. Underwood	S. Hewitt	Bullard King & Co., Ltd.	30.1.47
Umtata	J. W. Miles	N. C. Beadle		Bullard King & Co., Ltd.	8.1.47
Valacia	W. Stewart	A. W. Foyle		Cunard White Star, Ltd.	
Vancouver City	B. Carnaffan	M. J. Cheary, O. J. Lindsay, J. King	J. J. Dean	Sir W. Reardon Smith & Sons, Ltd.	29.4.47
Vardulia	F. E. Patchett	L. H. Pound		Cunard White Star, Ltd.	
Vasconia	G. H. Morris	A. L. Davies, R. G. W. Clayton, M. Duke	N. J. Ryan	Cunard White Star, Ltd.	28.1.47
Victrix	E. Garnett	C. F. Lawrence		Henrikson & Co.	
Vienna	A. P. Sutton	S. C. Dale, D. Elliott	J. H. Donaldson	London & North Eastern Railway	
Vivien Louise	G. McLeod	E. W. C. Sullivan	A. S. G. Broadbent	Arthur A. Rapp	28.2.47
Volo	A. Morrill	F. Briggs, O.B.E., P. Shawcross, R. F. Bramley	W. Ellison	Ellerman's Wilson Line, Ltd.	26.6.47

Name of Vessel	Captain	Observing Officers	Senior Radio Officer	Owners	Last Return Received
Waimana	T. T. Oliver			Shaw, Savill & Albion Co., Ltd.	
Waipawa	W. G. West	R. F. Hamilton, D. MacCullum, A. O. Griffiths	J. Hammond	Shaw, Savill & Albion Co., Ltd.	26.3.47
Wairangi	H. S. Cox	C. H. Saddington	H. Jardine	Shaw, Savill & Albion Co., Ltd.	7.5.47
Waiwera	B. Forbes-Moffat	J. L. Carroll, J. G. Fairgrieve, A. H. Baber	W. H. Holmes	Shaw, Savill & Albion Co., Ltd.	3.4.47
War Nizam	J. Hall	G. Baxter		Bulk Storage Co.	
Warwick Castle	R. Wren, D.S.O.	J. C. Campbell, J. R. Henderson, O. G. A. Peers-Jones	R. Brew	The Union-Castle Mail Steamship Co., Ltd.	24.6.47
Welsbach	P. E. Bedford			Merchants (Fleetwood), Ltd.	
Winchester Castle	W. A. Pace, O.B.E.	G. Murray	J. Hodgson	The Union-Castle Mail Steamship Co., Ltd.	18.4.47
Worcestershire	R. S. Evans	M. Mills, R. D. Fielder, W. O. Thomas	W. G. Fletcher	Bibby Line, Ltd.	14.7.47

FLEET LIST (New Zealand)

The following is a list of observing ships, co-operating with the Meteorological Service of New Zealand.

Name of Vessel	Owners
Kaikorai	Union S.S. Co. of New Zealand, Ltd.
Kairanga	Union S.S. Co. of New Zealand, Ltd.
Karetu	Union S.S. Co. of New Zealand, Ltd.
Karitane	Union S.S. Co. of New Zealand, Ltd.
Kauri	Union S.S. Co. of New Zealand, Ltd.
Kurow	Union S.S. Co. of New Zealand, Ltd.
Lautoka	Lautoka Steamship, Ltd.
Matai	New Zealand Government.
Matua	Union S.S. Co. of New Zealand, Ltd.
Maui Pomare	Government of New Zealand (Pacific Islands Administration).
Pamir	New Zealand Government.
Port Waikato	Holm Shipping Co., Ltd.
Wahine	Union S.S. Co. of New Zealand, Ltd.
Waipori	Union S.S. Co. of New Zealand, Ltd.
Waitaki	Union S.S. Co. of New Zealand, Ltd.

MARID SHIPS

The following is a list of ships voluntarily observing and reporting sea temperatures from coastal waters of Great Britain.

Captains are requested to point out any errors or omissions which may occur in the list.

Name of Vessel	Captain	Owners
Accrington	R. Good	L. & N.E. Railway.
Actuality	J. Lewis	F. T. Everard & Sons, Ltd.
Adjutant	K. R. Nichols	General S. N. Co., Ltd.
Alouette	G. C. Longfield	General S. N. Co., Ltd.
Antwerp	R. H. Wright	L. & N.E. Railway.
Ariosto	— Reeves, O.B.E., D.S.C.	Ellerman's-Wilson Line, Ltd.
Atlantic Coast	F. Mara	Coast Lines, Ltd.
Baltraffic	F. Waldron	United Baltic Corporation.
Bury	J. L. Davison	L. & N.E. Railway
Cambria	A. Marsh	L.M.S. Railway, Holyhead.
Clyde Coast	D. Cowan	Coast Lines, Ltd.
Coldharbour	G. L. Hetherington	Wm. Cory & Son, Ltd.
Coldridge		Wm. Cory & Son, Ltd.
Corfen	E. Allen	Wm. Cory & Son, Ltd.
Corfoss	A. Greiffenhagen, M.B.E.	Wm. Cory & Son, Ltd.
Corfleet	R. J. Barrow	Wm. Cory & Son, Ltd.
Cormoat	R. B. Armstrong	Wm. Cory & Son, Ltd.
Cormist	H. H. Horley	Wm. Cory & Son, Ltd.
Cortachy	J. Stewart	Dundee, Perth and London Shipping Co., Ltd.
Crane	E. C. Paynter, D.S.C.	General S. N. Co., Ltd.
Crichtoun	H. M. Brown	G. Gibson & Co., Ltd.
Denbigh Coast	E. C. Maddrell	Coast Lines, Ltd.
Drake	J. S. Lickis	General S. N. Co., Ltd.
Duke of Argyll	W. Thompson	L.M.S. Railway, Heysham.
Duke of Lancaster		L.M.S. Railway, Heysham.
Duke of Rothesay	F. Ardern, D.S.C.	L.M.S. Railway, Heysham.
Duke of York		L.M.S. Railway, Heysham.
Eastern Coast	R. E. Holt	Coast Lines, Ltd.
Falcon	F. W. Wethy	General S. N. Co., Ltd.
Goldfinch	W. Lockhart	General S. N. Co., Ltd.
Granta	D. A. Hunter	Withertington & Everett.
Guernsey Coast	C. Metcalfe	British Channel Islands S.S. Co.
Hantonia	A. L. Light	Southern Railway, Southampton.
Harrogate	C. H. Tully	Associated Humber Lines.
Hibernia	W. H. Hughes, D.S.C.	L.M.S. Railway, Holyhead.
Highwood	J. Coupland	E. R. Newbiggin, Ltd.
Hirondelle	— Klamp	General S. N. Co., Ltd.
Isle of Jersey	H. H. Golding	Southern Railway, Southampton.
Isle of Sark	F. Front	Southern Railway, Southampton.
Lairdsburn	J. McColl	Burns & Laird Lines, Ltd.
Lairdswood	I. McGuggan	Burns & Laird Lines, Ltd.
Lancashire Coast	B. Williams	Coast Lines, Ltd.
Lapwing	W. G. James	General S. N. Co., Ltd.
London Merchant	C. A. Piper	London Scottish Lines.
Mallard	H. Clayton	General S. N. Co., Ltd.
Medway Coast	E. A. Jones	Coast Lines, Ltd.
Melrose Abbey	J. Laverack	Ellerman's Wilson Line, Ltd.
Minna	T. Mather	Scottish Home Department.
Moray Coast	E. Griffiths	Coast Lines, Ltd.
Norna	W. Pirrie	Scottish Home Department.
Northern Coast		Coast Lines, Ltd.
Ocean Coast	J. Webber	Coast Lines, Ltd.
Otterhound	A. M. Kennedy	Coastal Tankers, Ltd.
Pass of Ballater	R. Reid	Bulk Oil S.S. Co., Ltd.
Persian Coast	T. Taylor	Tyne, Tees S.S. Co., Ltd.
Petrel	Tomlin	General S. N. Co., Ltd.
Plover	F. Stranger	General S. N. Co., Ltd.
Royal Daffodil	A. Paterson, D.S.C.	General S. N. Co., Ltd.
St. Andrew		G. W. Railway, Cardiff.
St. Julien	L. J. Richardson	G.W. Railway, Cardiff.
Salerno	A. Morrill	Ellerman's Wilson Line, Ltd.
Scottish Co-operator	T. Robertson	Scottish Co-operative Wholesale Society.
Selby	A. W. Johnson	Associated Humber Lines.
Slieve Bawn	J. Hughes	L.M.S. Railway, Heysham.
Slieve Bearnagh	A. E. Wilmott, D.S.C., R.D. Cdr., R.N.R.	L.M.S. Railway, Heysham.
Slieve Bloom	E. G. J. Manning	L.M.S. Railway, Heysham.
Slieve League	V. S. Phillips	L.M.S. Railway, Heysham.
Slieve More	R. Woodhall	L.M.S. Railway, Heysham.
Southern Coast	W. Quirk	Coast Lines, Ltd.
Stork	C. Carr	General S. N. Co., Ltd.
Supremity	S. F. Wilson	F. T. Everard & Sons, Ltd.
Tern	G. Thain	General S. N. Co., Ltd.
Wandle	T. W. Corney, M.B.E.	Wandsworth and District Gas Co.
Welsh Coast	M. Fleming	Coast Lines, Ltd.

NOTICES TO MARINE OBSERVERS

Postal Arrangements

The quarterly numbers of the *Marine Observer* are published on the last Wednesdays of December, March, June and September.

If Captains of the observing ships will forward to the Meteorological Office the particulars required hereunder, endeavour will be made as far as mails permit to post the latest number with appropriate forms for observational work for use on their homeward passage.

S.S./M.V.. Captain..............................

Port of Call ....

Date of Homeward Departure ....

Postal Address ....

When this information is not given the *Marine Observer* will be addressed to the Commanding Officer, S.S./M.V............................. , c/o the owners, and captains are requested to make their own arrangements for forwarding.

Shipowners, Marine Superintendents, and all concerned in the despatch of mails to ships abroad are asked to kindly facilitate the despatch and delivery of postal matter, received at their offices from the Meteorological Office and Air Publications and Forms Stores, to their ships abroad.

This matter, addressed to the Commanders of Ships, contains information which is required for the Conduct of Meteorological Work at Sea, and is most effective if received by the commanders at the earliest possible date.

Much of the information referred to is published in the *Marine Observer* and is of a seasonal nature. This journal also contains advice to observing ships which enables them to perform voluntary service by wireless communication for the benefit of all shipping.

Ice Observation

Drifting ice, derelicts, and other floating dangers to navigation are reported by all means of communication at the disposal of the master.

See Appendix III, pages 106-108 of the *Marine Observer's Handbook*, Sixth Edition.

It is also desirable that more detailed information than can be given in a TTT wireless message should be available to the Meteorological Office for the purpose of research, and for the Admiralty Charts and Sailing Directions.

Marine observers will greatly assist by noting the conditions of ice, either drifting or fast..

For this purpose Form 912 is supplied direct to all regular observing ships using regions where ice may be encountered, and this Form may be supplied to the captain of any British ship on application to the Port Meteorological Officers and Merchant Navy Agents.

Regular observing ships using the Trans-North Atlantic tracks are requested to send in these Forms, not only when ice is encountered, but also when they have passed through the ice region during the ice season without encountering ice. In this case a " nil " report should be returned, since it is desirable as far as possible to determine when tracks have been clear of ice.

Return of Logbooks

Owing to the need for strict economy in the use of paper, observing officers should endeavour to fill up their logbooks (Forms 911), before returning them to the appropriate Meteorological Service, except when insufficient space remains for the recording of observations during a further complete passage.

MARINE METEOROLOGY

Co-operation of British Shipowners, Masters and Mates

Captains and officers of ships registered in Great Britain and Northern Ireland, who wish to co-operate regularly with the Meteorological Office, should apply to the appropriate Port Meteorological Officer or Agent, a list of whom, with addresses, is given below.

In accordance with the International Convention for Safety of Life at Sea, the Meteorological Office arranges for a number of ships to record meteorological observations at specified hours, throughout their voyage, and to transmit coded observations, by wireless telegraphy, for the benefit of other ships and the various meteorological services.

Ships regularly performing these voluntary duties are known as Observing Ships—the whole as the Voluntary Observing Fleet—and the commanders and officers of these ships as the Corps of Voluntary Marine Observers.

The list of regular observing ships with the names of commanders, officers, and other particulars, is published in the *Marine Observer*.

The quarterly *Marine Observer* is sent regularly to the captain of every observing ship, for the information and guidance of his observing and radio officers. The captains of observing ships are also supplied on request with charts and atlases, according to trade, as meteorological equipment.

To ensure the accuracy of data collected for the purpose of research and for weather forecasting, ashore and afloat, and to provide a pattern, which may be copied with advantage to all concerned for general use in merchant ships, sufficient tested instruments are lent by the Meteorological Office to the captains of observing ships.

Commanders of observing ships are requested to return their Fair Logbooks (Form 911) when full, or when insufficient space remains for the recording of observations during a further complete passage, to the Meteorological Office.

Pages from the Coded Messages Record (Form 911A), when filled, or at the end of each voyage, should be detached, folded, and returned to the Meteorological Office.

The Port Meteorological Officers and Merchant Navy Agents inspect instruments in observing ships quarterly, when possible, and they will replace, as necessary, any gear lent by the Meteorological Office. These officers will also check the accuracy of barometers, etc., in observing ships, but marine observers should themselves frequently check by comparison.

NAUTICAL OFFICERS AND AGENTS OF THE MARINE DIVISION OF THE METEOROLOGICAL OFFICE, AIR MINISTRY

Captains and observing officers of the Voluntary Corps of Marine Observers will always be welcomed at headquarters, where the Marine Superintendent will be pleased to show them how their observations are utilised in meteorological research and weather forecasting.

Headquarters

Commander C. E. N. Frankcom, O.B.E., R.D., R.N.R., Marine Superintendent, Meteorological Office, Air Ministry, Headstone Drive, Harrow, Middlesex. (Telephone : Harrow 4331, Ext. 324).

Commander J. Hennessy, R.D., R.N.R., Deputy Marine Superintendent. (Telephone : Harrow 4331, Ext. 323).

Mersey

Commander M. Cresswell, R.N.R., Port Meteorological Officer, Room 617, Royal Liver Building, Liverpool, 3. (Telephone : Central 6565).

Thames

Commander C. H. Williams, R.D., R.N.R., Port Meteorological Officer, Room 4, Ibex House, Minories, London, E.C.3. (Telephone : Royal 1721).

AGENTS

Bristol Channel

Captain E. Hall, Room 120, Exchange, Mount Stuart Square, Cardiff Dock.

Clyde

Captain W. W. Elliott, c/o Messrs J. Goldie & Sons, 27 Oswald Street, Glasgow, C.1. (Telephone : Central 7435).

Forth

Captain G. More, " Craigneuk ", Dechmont, West Lothian. (Telephone : Dechmont 19).

Humber

Captain R. E. Dunn, c/o Principal Officer, Ministry of Transport, Trinity House Yard, Hull.

Southampton

Captain Sir Benjamin Chave, K.B.E., Royal Mail House, Southampton.

Tyne

Captain F. B. West, Custom House Chambers, Quayside, Newcastle-on-Tyne. (Telephone : Newcastle 23203).

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