VAN RIEBEECK'S ROUTE TO THE CAPE

1. A voyage from Europe to the Cape can to-day be plotted with complete accuracy on a chart of the Atlantic. Is it possible to do the same for the route of a seventeenth century sailing ship? In answering this question the following points should be taken into account.

(a) The determination of latitude was already remarkably good, though the instruments as well as the method used were primitive. For the required observations it was necessary to have a clear sky exactly at noon. On some days in the Journal the observed latitude is given the special qualification "good"; presumably when conditions of sea and atmosphere favoured precise measurements. If the sky was overcast at noon an estimated latitude only could be entered into the journal.

The observed latitudes can be accepted as correct; no importance should be attached to differences of less than five minutes. The diarist himself considered an uncertainty of 5 or 6 minutes in a determined latitude as normal (29 march 1652). Even the estimated latitudes can be used freely, as any probable error is of little importance on the small scale of our charts.

(b) The determination of longitude was unsatisfactory; the methods in use provided as rough estimate only. Errors of many degrees were possible.

(c) Changes in the direction and force of the wind could compel the skipper to alter his course many times a day. Zigzagging and even partially retracing the course were by no means exceptional. In such cases it was hardly possible, when entering the noon observations in the Journal, to determine with mathematical precision what the resultant course and the distance covered has been during the preceding 24 hours. Small errors in these data are to be expected.

(d) The influence of ocean currents was imperfectly known. For this reason, as a rule, only the course steered could be given in the Journal, and this might differ a good deal from the actual course.

(e) In consequence of wrong longitudes, accepted by the seventeenth century cartographers, maps of the period still contained a number of errors in the form and situation of the coast lines. The Cape *e.g.* was often placed 6 degrees too far east. The observations made had accordingly to be fitted into a geographical picture which in itself was not always right; this must have had an unfavourable influence on their interpretation.

The remarks under (b)—(c) make it clear that a reconstruction of the route can be approximately correct only. The available information is sufficiently accurate, however, to make the work worth while. Plotting the data on a chart will greatly help us to understand the Journal.

2. Before we can do this, we have to decide what was meant by the *mile* of the Journal, and what was the *prime meridian*.

(a) The seafarers of seventeenth century Holland were accustomed to reckon in

Dutch miles, equal to 4 minutes of the meridian (or 4 nautical miles). There were, however, cases when other measures were used, like the Spanish mile *e.g.*, a relic from the days of the great discoveries. This was close enough to the Dutch mile to make confusion possible, one degree of the meridian being equal to 15 Dutch and 17½ Spanish miles.

Useful data are given in the Journal on 2 and 11 January 1652. The difference in latitude between the 10th and the 11th is 2°24′. The course given is south, and this means that 144 minutes should equal 36 Dutch or 42 Spanish miles. The Journal gives 38, which fits the Dutch mile much better than the Spanish, especially if we reckon with occasional small deviations from the main course. Deviations influence the distance sailed, but not the latitude.

On January 2 we are dealing with the difference between two estimated latitudes. Though less trustworthy for the determination of position, these data have the same value as observed latitudes when it comes to deciding what the diarist had in mind. The distance sailed forms the hypothenuse of a right-angled triangle. If we accept the course as correct, the other two sides are equal, being each 21.25 Dutch miles. This makes the distance sailed 30 Dutch or 35 Spanish miles. If we trust the accuracy of the longitudes better than that of the course given, the two sides of the right angle are respectively 21.25 and 19.65 Dutch miles, making the hypothenuse 29 Dutch or 33.8 Spanish miles. The Journal gives the distance sailed as 30 miles. This figure is exactly the result in Dutch miles of our first method of calculation, and gets very close to that of the second.

We conclude that Van Riebeeck reckoned distances in the customary Dutch mile.

(b) The prime meridians of the sixteenth and seventeenth centuries are based on Ptolemy, who counted longitude from the Insulae Fortunatae. Renaissance geographers followed him, but differed about the exact group, outside the Strait of Gibraltar, with which these islands were to be identified. In the sixteenth century the Canary and Cape Verde Islands, as well as the Azores, were all used in turn. During the seventeenth century the Canary Islands were generally preferred, but there remained uncertainty about the selection of a definite point in this group. To end the confusion Richelieu called a meeting of French experts, who decided in favour of Ferro, the most westerly island (1634). In the early eighteenth century geography and geodesy began to experience difficulties because the longitude of Ferro itself was not fixed with sufficient accuracy. On the advice of G. de l'Isle (1720) the meridian of Ferro was defined as that running 20 degrees west of the Paris observatory (in reality the island lies 20 minutes further west). In this artificial form the meridian of Ferro gained international recognition, and was supreme until, in the nineteenth century, it was abandoned in favour of a line through Greenwich.

In 1652, however, the Netherlands were by no means ready to accept the French decision of 1634. The great cartographers of Amsterdam dominated the world

market in maps, and generally preferred the meridian of Tenerife. This island is not only the largest in the group, but also the highest, its Peak of over 12.000 feet being visible for an enormous distance. Van Riebeeck's views can be tested by his estimate of longitude in the neighbourhood of the Canary Islands. The important date is January 14, when both Gran Canaria and Tenerife were sighted. For each island mentioned in the Journal our chart indicates by means of a circle the theoretical limit of visibility. This has been calculated for an observer at sea-level; the look-out man in the mast could see somewhat further. On the other hand atmospheric conditions are rarely good enough to permit visibility up to the mathematical limit. Moreover it is difficult to recognize an island when only the extreme summit of its highest mountain appears above the horizon. Though it is probable that on January 14 at noon both Gran Canaria and Tenerife were visible, we cannot state this as a certainty, because the actual range of visibility must have been somewhat less than indicated by the circles. Even if both islands had already disappeared from sight, however, the moment must still have been exceptionally favourable for a good estimate of position. Van Riebeeck gives his longitude as 40 minutes (east), which means that his prime meridian runs at this distance west of the point of observation. The latitude of this point is fixed; its longitude is, within certain limits, open to discussion, depending on the interpretation of the figures given for course and distance. It cannot be placed so far east, however, that the prime meridian would cross Gran Canaria. At the utmost we could fix the line between this island and Tenerife (say at 16° west of Greenwich). A line across the last-named island itself, however, fits in more naturally with the wording of the Journal.

We conclude that Van Riebeeck's prime meridian was that of Tenerife, and we select the round figure of 16° 30′ west of Greenwich. This line crosses the centre of the island, slightly east of the Peak.

3. Seventeenth century navigation differed in many respects from that of to-day. We have already seen that the skipper rarely knew his exact position. Consequently, in trying to avoid certain dangers, he had to allow for a wider margin of safety than would have been necessary with good knowledge of his longitude. Moreover the low speed (five nautical miles an hour was a good average) made the disturbing influence of currents much more important than at present. The main point, however, was the complete dependence on the vagaries of the wind, which often made it impossible to bring a ship where the master wanted. Great detours were often necessary; and precautions had to be taken long in advance against the risk of unfavourable wind at critical points of the route. Planning a voyage was a more complicated matter than to-day, and much more uncertain. The skipper was far more at the mercy of the elements than his modern counterpart, and it is not strange that he felt strongly the need to rely on Higher Powers.

A ship need not sail before the wind to make good progress; very satisfactory speed

can be reached with side-wind, and even with the wind obliquely in front. In this last case the ship is sailing "close to the wind"; the fact that European vessels were better built for this purpose than those of the monsoon-countries was one of the reasons for the white man's maritime supremacy in the Indian Ocean. Specially rigged racing-yachts can use three-fourths of all wind-directions; only a quarter of all directions, i.e. 45° on each side of the desired course, being considered as adverse winds. For modern trading-vessels we reckon this angle of unfavourable wind directions about 50 % larger, i.e. 67½° on each side of the desired course. It is remarkable that according to the Journal the same opinion was held about the limit of what Van Riebeeck's ships could do. The diarist does not reckon in degrees, however, but in points of the compass, each of 11¼°, the whole circle being divided into 32 points. The diarist considers it impossible to sail closer to the wind than six points.

It may be stated here that the Journal rarely makes finer distinctions of direction than one point of the compass (sometimes ½ point). Evidently the available instruments were not fit for more precise observations. In some cases the diarist is even in doubt between two full points. We must therefore be prepared for an uncertainty of a few degrees in all directions given; in some cases perhaps as high as 10°.

In an adverse wind a sailing ship is not quite helpless; there remains the possibility of tacking, i.b. climbing against the wind in a zigzag-course. This is slow work, however, especially when the current is also unfavourable. Moreover tacking requires room; in narrow straits or between banks and rocks it becomes impossible. The need of room for manoeuvring was the reason why sailing ships always tried to avoid getting into narrow places.

4. The reconstruction of the route leads us to distinguish between four different sections of the voyage, each with its own problems.

(a) *From Texel of the Mouth of the Channel.* Amsterdam was situated on the IJ, a long narrow inlet of the Zuiderzee, affording safe anchorage for thousands of ships, but not eastily accessible from the open sea. Its mouth was obstructed by the Pampusbank and when outward-bound ships had crossed this (often with considerable difficulty), there remained the trouble of negotiating a passage through the winding channels between the sandbanks and mud-flats of the "Wadden". There were two exits towards the North Sea, viz. through the Vlie, and south of Texel; the last named was most frequently used. In the roadstead of Texel the ships had to wait for an easterly wind before they could put to sea. As the dominant winds were westerly, this could take quite a few weeks, in which case a large number of ships gradually assembled here. The time was used for making good any shortage of supplies that might be discovered, and for last minute administrative arrangements.

Van Riebeeck went on board the Drommedaris on December 16; she was then lying in the Balgh, a channel between Wieringen and the point of North Holland. After taking in her last supplies, she was enabled on the 20th by a favourable combination of wind and tide to sail for the roads of Texel, where she arrived together with the *Reijger*. Here she was joined two days later by the *Goede Hoop*, and on the 24th an easterly wind enabled the three ships to put to sea, together with a large fleet of merchantmen who had been waiting for the same opportunity.

About 5 p.m. on the 24th the fleet was in the open sea, and 19 hours later the Journal gives the first estimated position as 26 miles south-west of Texel. Good progress was made until late in the afternoon (say about 4 p.m.), but then the wind turned, and for the next 24 hours there was hardly any progress. To avoid the Flemish Banks, the voyage from Texel had been made out of sight of the coast, and in the evening of the 25th the position was already sufficiently uncertain to make special caution necessary. According to estimate the ships were between the Polder (one of the Flemish Banks) and the Goodwin Sands, but it was unknown how near these dangers might be. With the wind blowing towards the banks, the circumstances were somewhat awkward. The wording of the Journal suggests that the ships did not anchor, but sailed slowly up and down, taking soundings, and keeping between 20 and 23 fathoms. At noon on the 26th, however, the position could be approximately fixed by sighting Cape Blanc Nez, and towards evening definitely by another bearing taken on the same point. The distance sailed in 24 hours is given as 10 miles at noon, but most of this must have been covered in the afternoon of the 25th, before the wind turned. At 10 p.m. on the 26th a N.N.W. breeze sprang up, which enabled the ships to pass the Strait of Dover during the night; this could safely be done in darkness, as the position was accurately known. On the 27th and 28th they sailed, close to the wind, along the English coast, sighting Beachy Head, Wight, and (presumably) Start Point, but on the 29th the wind veered so far west that the ships were driven towards the French coast. This created the danger of getting behind Ushant, from where it would have been difficult to leave the Channel. The problem resembles that of leaving Texel, but now the position was again imperfectly known, while on the other hand there was plenty of room to manoeuvre. Accordingly the ships went on a northward tack, sailing close to the wind, back towards the English coast. The wind increased in strength, the nearness of the ocean made itself felt, and the officers were convinced that the *Drommedaris* was too "cranky" for the great voyage (i.e. her stability was insufficient on account of careless lading). It was therefore resolved to call at an English port, and take ballast. Another change of wind direction made this impracticable, but proved favourable for leaving the Channel, and now Van Riebeeck, anxious to avoid further loss of time, accepted the risk and sailed into the Atlantic. It is interesting to note that military motives prevented the use of a simple method of improving the ship's stability, namely, taking some of the

guns down to the hold. This would have left the *Drommedaris* defenceless, and it was only on the 20th of February, south of the equator, that the Commander felt justified in bringing down at least half the guns.

(b) *From the Channel to the Cape Verde Islands.* During the first eight days position was determined by taking bearings on landmarks, where possible. On entering the Atlantic the expedition began to rely on estimated longitudes. The Journal does not show what method the skippers used for this purpose, but the results are certainly too good to be mere guesswork. On the other hand sufficient error could accumulate in a few days to cause single islands to be missed (Madeira, January 10), and groups like the Canary and Cape Verde Islands to be crossed a good deal further east than was anticipated. At the first view of the Canary Islands, 15 days after the last previous landmark had been sighted, the error in longitude was over 1⅛°. Between the last view of Tenerife (January 14) and the first of the Cape Verde Islands (January 21) the error amounts to 40 minutes. In such cases, where estimated longitude can be corrected by position with respect to definite landmarks, it would be wrong to make a sudden jump eastward in the plotting of the route. We have to spread the adaptation over a number of days. In the first case this has been done by correcting the positions for January 10 and 11 from that found for the 12th, and by further distributing the adaptation over the three preceding days (January 7-9). The correction of January 21 has been spread over three days.

Two dates merit special attention: January 5 and 7. On the 4th Cape Finisterre had been passed, outside the limit of visibility; but on the 5th the wind veered W.S.W., and the slightest further shift to southward would make it impossible to keep sufficient distance from the Spanish and Portuguese coast. For this reason the ships went on a backward tack, sailing N.W. close to the wind, to get into the open sea. After a single hour, however, the wind veered back to W.N.W. and the original course could be resumed. On January 7 Berlengas is passed, also without being seen. This is the principal island of a small group off Cape Carvoeiro. The name is sometimes interpreted as plural and used for the whole group, as is done in the Journal. Such islands were particularly dangerous for ships sailing southward, parallel with an invisible coast. If once they got behind them, it might be very difficult to reach the open sea again. Therefore the skippers were as a rule greatly relieved when the noon observations showed that the dangerous latitude had been passed.

(c) *From the Cape Verde Islands to Latitude* 27½° S. Between the last view of Ilha de Mayo in the Cape Verde Group and the sighting of Table Mountain there are 2½ months, when nothing is seen but sea and sky. In so long a period errors and uncertainties in the determination of longitude are unavoidable. In discussing this part of the route, we shall not dwell upon the well-known fact that winds and currents make it impossible for a sailing ship to steer a direct course from the Cape Verde Islands to the Cape.

During the first week after passing Ilha de Mayo good progress is made in a slightly easterly direction, with positions that can be clearly determined from the Journal. It was evidently the intention to cross the equator so far east that there would be no danger of drifting towards the north coast of South America, or getting behind the Abrolhos, the much feared rocky islands on the Brazilian east coast. Modern sailing vessels, with accurate knowledge of their longitude, can risk the crossing a full six degrees further west, thereby avoiding the worst part of the Doldrums. This difference was well known to the seventeenth century mariners, but uncertainty about longitude forced them to take the more easterly course; the dangers of the Brazilian coast might cause a more serious loss of time than the belt of calms. This dilemma was then considered the most difficult point in the whole East Indian navigation.

The troubles start during the last days of January; for the next three weeks there is only 7 degrees progress towards the south. Probably there were different days when change in position was determined more by the current than by the wind. This explains the uncertainties and seeming contradictions in the data for position, course, and distance covered. In reconstructing this part of the route, a more or less arbitrary choice between different possibilities is sometimes necessary. The data become clearer again from February 20 to 23; but then comes a strange part of the Journal: for 15 days no particulars are given at all. We have to be content with a few general indications, and our reconstruction of the route becomes more or less hypothetical.

What we know is that, till noon on the 24th, the wind was E.S.E., and the course S. by W. Now follow five days of southerly winds and fairly good progress. In comparison with the preceding days it seems reasonable to presume that "southerly" means a direction at least somewhat farther south than S.E.; as a matter of fact this is confirmed by the remark of March 1-9 which reads "*still* mostly S.S.E. winds". The most southerly course possible with S.E. wind is S.S.W.; for S.S.E. wind it is S.W. It remains to make an estimate of the distance covered during these five days. Fairly good progress may be taken to mean an average of 20 Dutch miles a day through the water, to which we add 7 miles as daily average for the Brazil Current. This makes 135 miles in five days, and if we plot this in a S.S.W. direction, we get a course passing west of Trinidad; how far to the west depends on the interpretation of "southerly winds". We may assume that the position of February 29 lies at least 30° W. of Greenwich and near the limit of the tradewind-belt. Here wind and current begin to favour a southerly, and later a south-easterly course. Most probably Van Riebeeck's route came here very close to the one prescribed for present day sailing vessels.

(d) *Crossing the South Atlantic.* From March 12 the positions are on the whole clearly indicated again, while those for March 11, 10, and even 9 can be reasonably

well fixed by reckoning backward. On nearing the Cape there is an error in longitude of over 2 degrees, but now easterly, whereas north of the equator the estimates used to be too far west. The position given for noon, April 5, lies in reality in the Groot-Drakenstein Mountains, south-east of Pniël; for Van Riebeeck this can hardly have appeared very strange, as the maps of his days placed the Cape a good deal farther east still.

We now have to decide how to eliminate this error from our plotting. As mistakes of this kind have a way of accumulating gradually, it seems improbable that the position of March 12 already represents the full error. But on the other hand it would be risky to assume that the longitude for March 12 is quite correct. The solution chosen here is a westward shift of 2 degrees in the position of April 5, and of 1 degree for March 12, with proportionate corrections for the intervening dates.

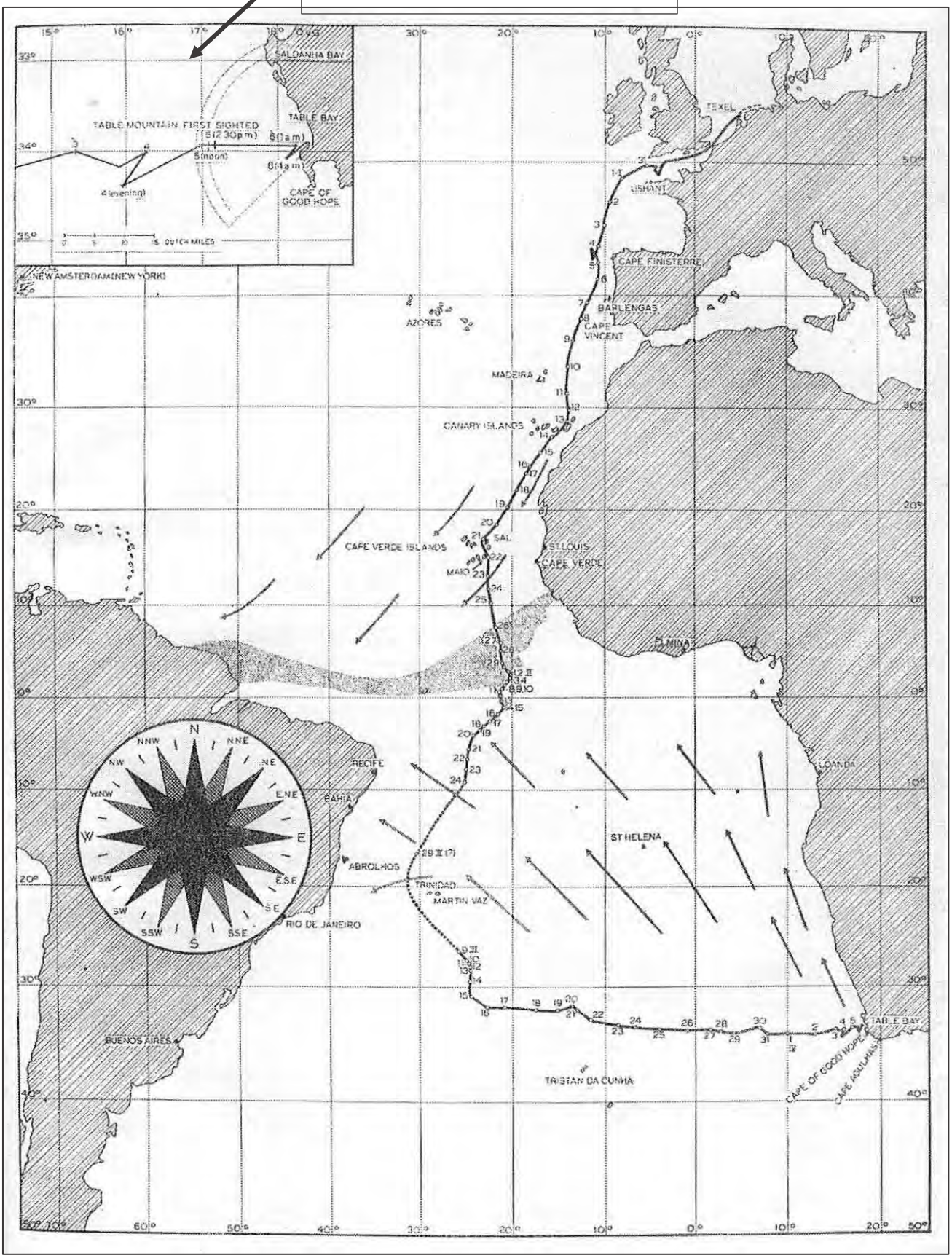
The method for obtaining a good landfall was the primitive one, then in use, of "sailing down the latitude"; i.e. after reaching the right parallel the ships maintained an easterly course, with the certainty that sooner or later the Cape must be reached, irrespective of any error in longitude. This part of the route begins on March 23, and on the 29th a meeting of officers from all three ships averaged the estimates of longitude and latitude, and resolved to follow the parallel of 34° 20′. This course, aiming at Cape Point rather than at Table Bay, was evidently a measure of precaution in view of the northward setting current, though very soon this proved stronger than had been expected. As mentioned before, the remark about the margin of 5 of 6 minutes, to be allowed for in the determination of latitude, is interesting as showing the skippers' own opinion on the accuracy of their observations.

On the 30th already the northward drift is found to be so strong that a somewhat more southerly course has to be steered, which brings the ships back to the required latitude on April 1 and 2, and allows them to sail due east. At noon on the 3rd the drift has brought them too far north again, and as the wind veers south, it becomes necessary to steer close to it, S.E. by E., to keep the right latitude. In the morning of the 4th the wind veers S.E., making E.N.E. the best course possible, which brings them too far north, so that finally they have to go backward on a S.S.W. tack. Having gained latitude in this way, and getting towards evening a more favourable southerly wind, they steer east, knowing that the current will carry them back northward. At noon on the 5th they find indeed that the latitude is less than 34° again. At this moment they are, without knowing it, already inside the theoretical limit of visibility of Table Mountain. The inner circle on the chart has been calculated for observation from water level, the outer circle for an observer 60 feet up. The first view of the land is obtained 2½ hours later, and from this point the steering is done on land-marks, so that any drift can promptly be corrected. An hour after midnight they are so close to the shore that a short backward tack is made as a measure of safety, but at 4 a.m. on the 6th they turn to the land again. Variable winds

make progress slow, and as the mountains obstruct the view into Table Bay, a boat is sent to find out whether any hostile ships are present there. Late in the afternoon it is reported that the bay is free of shipping, and just at the right moment a southerly wind springs up which carries the *Drommedaris* and the *Goede Hope* round Green Point, to anchor in the bay shortly after sunset. The *Reijger*, being too far to seaward, can enter only next morning at daybreak.

P. SERTON

THE LANDFALL *(Inset)*
The circles indicate theoretical visibility of Table Mountain, from water level, and from sixty feet up (in the mast).



VAN RIEBEECK'S VOYAGE FROM TEXEL TO TABLE BAY
The Position has been indicated for each date, as far as given in the Journal. The Trade Winds and Doldrums are shown as found on an average during January. Van Riebeeck, however, was troubled with calms till well south of the Equator. Note that the South-east Trades become nearly south winds on the coast of Africa and nearly east on the coast of Brazil.