
OBSERVATIONS

IN RELATION TO

CYCLONES OF THE WESTERN PACIFIC:

EMBRACED IN A

COMMUNICATION TO COMMODORE PERRY,

BY

WILLIAM C. REDFIELD.

INTRODUCTORY NOTE.

The following paper, prepared by the lamented William C. Redfield expressly for this report, may be looked upon as the very last offering to practical science of that eminent man, it having been finished but a few days prior to the illness which terminated his life.

It was my good fortune to enjoy for many years the friendly acquaintance of one, as remarkable for modesty and unassuming pretensions, as for laborious observation and inquiry after knowledge.

To him, and to General Reid, of the Royal Engineers of England, are navigators mainly indebted for the discovery of a law which has already contributed, and will continue to contribute, greatly to the safety of vessels traversing the ocean.

It is true, that subsequent writers, Piddington, Thom, Fryers, Sedgewick and Bosquett, as mentioned in the 1st volume of this work, have furnished additional information upon the subject, but to Redfield and Reid should be ascribed the credit of the original discovery of this undeniable law of nature, and its application to useful purposes; and there can be nothing more beautiful, as illustrative of the characters of these two men, than the fact, well known to myself, that, notwithstanding their simultaneous observations and discoveries in distant parts of the world, neither claimed the slightest merit over the other, but each strove to give to his co-worker in research the meed of superior success in the great object of their joint labors; and thus, without ever meeting, a strong friendship was formed between them, growing out of congenial aspirations for honorable fame, and mutual admiration of the generous and enlightened views exhibited by each other; and this enobling feeling was kept alive to the last by friendly correspondence.*

I recollect, when sent abroad by the government, in 1838, to visit the dock-yards and light-houses of England and France, I was favored with a letter of introduction from Mr. Redfield to his friend, then Colonel Reid,† and I could well judge, by the many attentions and valuable services rendered to me by that distinguished officer, and his verbal enquiries, how highly he valued the recommendation of a man whom he had never seen.

M. C. PERRY.

* The last letters of General Reid arrived too late to be opened and read by the deceased.

† Now General Reid, and Governor of Malta.

OBSERVATIONS

IN RELATION TO

THE CYCLONES OF THE WESTERN PACIFIC.

BY WILLIAM C. REDFIELD.

NEW YORK, *December 26, 1856.*

DEAR SIR: The return to the United States of the naval expedition placed under your command by our government, for special service in the Asiatic seas, has furnished much valuable information on various subjects of general interest and importance. Of these beneficial contributions, the numerous geographical and hydrographical examinations made by the officers of the squadron, and the observations made and collected in relation to the tempestuous cyclones of the Western Pacific, cannot fail to promote the interests of navigation and commerce. The latter portion of these materials, together with such other notices of the gales and typhoons of the China Sea and the North Pacific Ocean as are now at hand, constitute the subject of this communication.

Cyclone of July, 1853.—The steamships *Susquehanna* and *Mississippi* left the bay of Yedo, in Japan, on the 17th of July, 1853, steering a southwesterly course, with the barometer at 30 inches, which is quite above the mean height of this instrument in the summer season on that coast, and was caused, apparently, by the exterior atmospheric wave of the approaching cyclone. On the 18th, the barometer commenced falling, with the wind at E.S.E., and was accompanied on the 19th by a heavy swell from the southeast quarter, in latitude $31^{\circ} 14' N.$, longitude $135^{\circ} 03' E.$; the center-path of the cyclone, thus approached by the ships, being at the distance of about five hundred and fifty miles, as now estimated. On the 20th, the cyclonic wind had veered to the east, increasing in force, and with "very heavy sea." At 6 P. M., the barometer had fallen to 29.36; below which it did not subside. The *Mississippi*, after lying twenty-four hours with head to S.E., with no indications of a favorable change, was placed with her head to N.E., when the rise of the barometer was very apparent, as appears by the master's report. The *Susquehanna's* barometer, at 9 A. M. of the 21st, stood at 29.36; and from this time it continued to rise slowly, and the strength of the gale was found to abate. On the 24th, the *Mississippi* was in latitude $26^{\circ} 25'$, longitude $128^{\circ} 10' E.$, near to Lew Chew, with barometer at 29.60, and the cyclonic wind had veered to E.S.E. On the 26th, at Lew Chew, the wind had veered round to the southward, and the barometer rose to 29.74; and on the 27th and 28th, attained 29.80, the usual height for July in that region.

From the known law which governs the cyclones in the northern hemisphere it results that these observations, as made by a single ship, are quite sufficient to show that this gale was a great cyclone, and was moving in the direction which is common in the lower latitudes; that it

was of great superficial extent; and that the position of these ships was far to the right of the path pursued by the axis of the gale. It is equally apparent that it belonged to a class of gales which are distinguished by the sluggish rate of their geographical progression. All this was manifested by the persistence of the easterly winds; by the slow and graduated effect of their cyclonic action, as seen in the fall and subsequent rise of the barometer; and by the gradual veering of the winds towards the south, as the cyclone passed off. It has sometimes happened that a ship placed in a similar position in a cyclone, has run in nearly a direct course parallel to its path, for several days, without any considerable change in the direction of the storm wind. Hence it has been inferred, erroneously, that the gale was not a cyclone. A better knowledge of the cyclones will enable the mariner to avoid this error.

But we have further knowledge of the great extent and slow progression of this storm, obtained from direct observations in the adjacent parts of the Pacific ocean. The *Saratoga*, which left Yedo bay with the steamships, bound for Shanghai, on a track more northerly than was pursued by the steamships, encountered in like manner the heavy sea and strong winds from the eastward; and on the 21st was hove to, in latitude $29^{\circ} 1'$, longitude $129^{\circ} 37'$; and likewise on the 23d and 24th, near latitude $30^{\circ} N.$, longitude $124^{\circ} E.$, and was off Saddle island, near the mouth of the Yang-tsz river, from 27th to 30th, having then southeasterly winds, with squalls and continued bad weather. The barometer reached its lowest point, 29.60, at noon of 24th, in latitude $29^{\circ} 28'$, longitude $128^{\circ} 17'$, with the wind at E.N.E., and afterwards veering to S.S.E., as with the steamships. We have no observations made nearer to the right border of the cyclone.

Next in order of the gale's progression, we have the observations found in the master's report of the United States store-ship *Supply*, then lying at Napha, Lew Chew islands, latitude $26^{\circ} 12' N.$, longitude $127^{\circ} 43' E.$, a position much nearer to the center-path of the cyclone. His tables show the maximum of the anterior barometric wave to have reached Napha as early as noon of the 12th, when the barometer stood at 30.02 inches; from which time to the night of the 17th, it slowly subsided to 29.84, with winds from the eastern board. On the 18th the wind had become strong, with an increasing fall in the barometer. On the 19th and 20th the gale blew from the northeast quarter, with increasing violence; and in its greatest force from the northward on the 21st. At 3 A. M. of this day the barometer had subsided to 28.88; and to 28.82 at noon, with a slight reaction at evening. At 3 P. M. of 22d it had settled to 28.74, its lowest point, from which it had only risen to 28.83 at midnight, with improving weather. On the 23d and 24th the wind veered through east to southeast, and the barometer rose more rapidly. It reached 29.80, the July mean of the region, on the 20th, when the wind had veered to south, with no further traces of the departing cyclone. The fall and rise of the barometer at Napha, as also with the other vessels, was not entirely gradual, but with very moderate fluctuations of some hours continuance, as is more or less common under other wide-spread cyclones. The gale, though of much violence at Napha, was not of the greatest intensity of hurricanes. It was observed by the officers "that even when the wind was piping loudest—when the water was whirled violently by in perfect sheets—the scud moved overhead at a remarkably slow rate, and the upper layer of clouds seemed scarcely to be stirred at all;" thus showing the very limited elevation of the superior surface of the cyclone. Its axial center, when near these islands, probably bore south from Napha near noon of 22d, at a distance which I now estimate at about eighty miles.

In further tracing its approach to the western limits of the Pacific, we have the log-book of

the United States store-ship *Caprice*, Lieutenant Wm. L. Maury, bound from Shanghai to Lew Chew. At 8 A. M., July 17, the *Caprice* left the mouth of Woo-sung river, and stood down the Yang-tsz river. Barometer at noon 29.71 inches, its maximum for this period. Anchored during the night, with a heavy ground swell from S.E. July 18th, barometer at noon 29.67. P. M., working out of the river with wind at S.E.; barometer at midnight 29.62; force of wind 2; and a heavy swell from S.E.

July 20.—Pleasant, and wind veers from E.S.E. to N.E. by E. with gradually increasing strength, 3 to 4; with very heavy swell from S.E. to E.S.E. Latitude at noon, $31^{\circ} 33' N.$, longitude $123^{\circ} 18' E.$; in 18 fathoms water. Weather still pleasant, with good breezes. At 6 P. M., barometer 29.42; took in sail and prepared for a gale; barometer rising to 29.50.

July 21.—Commences pleasant, with fresh breezes from N.E. by E., increasing, and heavy sea from E. At 10 A. M., gale at N.E. by N., force 7; barometer 29.40. Noon, latitude $29^{\circ} 30' N.$, longitude $124^{\circ} 42' E.$ 5 P. M., gale N.E.; barometer 29.35; at midnight 29.34.

July 22.—Gale N.E.; heavy sea from E. and N.E.; 3 A. M., barometer 29.27; 5 A. M., N.E. by E., increasing; 9 A. M., force 9; barometer 29.27; sea running from N.E., and rapid gale scud flying over. Noon, latitude D. R. $28^{\circ} 46'$; longitude, chron., $124^{\circ} 49'$. 1 P. M., gale E.N.E., force 10; 3 P. M., barometer 29.25'; squalls and rain. At 7 P. M., gale E. by N., 10; ship was hove-to; strong gales and high sea; rapid scud flying overhead.

July 23.—Lying-to throughout; a high and regular sea from E.N.E., with rapid scuds flying. 3 A. M., barometer 29.22; 9 A. M., gale east, 10; barometer 29.25. Noon, latitude D. R. $28^{\circ} 30' N.$, longitude, chro., $124^{\circ} 26' E.$; 3 P. M., barometer 29.23; 5 P. M., gale E. $\frac{1}{2}$ S., force 11; 9 P. M., gale E. by S.; barometer 29.23; spoon drift flying over the ship.

July 24.—Lying-to throughout; gale E. by S., force 10; high scud flying to westward with great rapidity. 3 A. M., barometer 29.22; 7 A. M., 29.20; 9 A. M., gale E.S.E.; barometer 29.18. Noon, latitude D. R. $28^{\circ} 26' N.$, longitude, chro. $124^{\circ} 47' E.$; 1 P. M., gale S.E. by 10 E., force 11, with heavy squalls of wind and rain, with irregular sea; 3 P. M., barometer at its minimum, 29.16; heavy cross sea, and spoon-drift flying over the vessel; sky overcast with clouds, passing over slowly to the westward; 5 P. M., barometer 29.18, clouds sluggish; 7 P. M., gale S.E., less severe; barometer 29.24; 11 P. M., barometer 29.27; clouds occasionally breaking, and passing to N.W.

July 25.—3 A. M., gale S.E. by S, force 8; barometer 29.25; squally, with light rain. 5 A. M., force 7; barometer 29.28. 9 A. M., gale increasing; rainy and squalls; barometer 29.32; sea moderating. 11 P. M., gale 8; barometer 29.34. Noon, latitude D. R. $28^{\circ} 51'$, longitude D. R. $124^{\circ} 03'$; gale S. E. 8. 3 P. M., gale S.S.E. 7, with cross sea; barometer 29.37. 9 P. M., gale S.S.E. 6; sky brightening to northward and patches of blue sky to S.E., and overhead.

July 26.—Wind strong at S. E. by S., force 6; barometer 29.50; scud passing to northward; sea from S.S.E. 9 A. M., a heavy and cross sea rising; barometer 29.52. Noon, latitude $29^{\circ} 31'$, longitude $125^{\circ} 16'$; in 40 fathoms water. P. M., wind and sea increasing, with heavy squalls; clouds [scud?] passing rapidly to N.W. At 5 P. M., gale still S.E. by S, force 8; barometer 29.49. Ends moderating, (7); barometer 29.51.

July 27.—At 5 A. M., gale S.E., 7; barometer 29.52; squalls increasing. 8 A. M., gale S.E. $\frac{1}{2}$ E., 8; scud low and thin, passing to northward; sea from southward, increasing. Noon, latitude D. R. $28^{\circ} 55'$, longitude D. R. $124^{\circ} 16'$; barometer 29.53; heavy squalls and rain; nimbus clouds passing to N.N.W. At 7 P. M., wind S.S.E. (6); barometer 29.55.

July 28.—1 A. M., strong winds (6) from S.S.E.; barometer 29.54; sea moderating. At 7

A. M., increasing to gale (7) from S.E. by E. ; barometer 29.56 ; noon same, with high, irregular sea ; barometer 29.58 ; latitude 29° , longitude $124^{\circ} 37'$; P. M., wind S.E. by S. (6) ; barometer 29.56—29.58. Ends with strong winds from S.E. and squalls.

July 29.—7 A. M., gale S.E. (7) ; barometer 29.55 ; low scuds flying to northward ; high and irregular sea from S.S.W. Noon, latitude D. R. $28^{\circ} 09'$, longitude D. R. $123^{\circ} 22'$; in 45 fathoms water ; barometer 29.56 ; gale S.E. by S. (7) ; scud flying to northward. At 3 P. M., gale S.S.E. (7) ; barometer 29.52. 6 P. M., strong gale (9) and squally, with rain and heavy sea. At 11 P. M., gale moderated to 5 ; barometer 29.58.

July 30.—Clouds breaking, clear to E. and S.E. ; strong breezes S.S.E. to S.E. ; clouds cumulo-stratus and nimbus, passing to N.N.W. At noon in 43 fathoms ; latitude 29° N., longitude $124^{\circ} 30'$ E. ; heavy sea from S.E., and swell from S.S.W. ; barometer 29.55 to 29.61.

July 31.—Strong breezes (6) from southward ; heavy swell from S.S.W. At noon under double-reefed topsail and foresail ; latitude D. R. $28^{\circ} 19'$, longitude $124^{\circ} 17'$; barometer ranging between 29.57 and 29.63.

August 1.—Fresh breezes, force 5, moderating to 4 ; heavy swell from S.S.W. Noon, latitude $28^{\circ} 35'$, longitude $125^{\circ} 09'$, in 50 fathoms. Barometer rises from 29.62 at 1 A. M. to 29.69 at midnight, or nearly to the same point as at the commencement of this very extended period of cyclonic action.

The phenomenon thus presented may be regarded as of much scientific and practical interest. It does not appear that the *Caprice* was at any time nearer to the axis of the cyclone than about one hundred and fifty miles. The greatly prolonged influence of the cyclone upon her barometer was nearly equable ; its movement being unusually steady during its successive gradations. The entire range of the barometer during a period of seventy-two hours, from 3 A. M. of the 22d to same hour of 25th, was scarcely more than one-tenth of an inch, or between 29.27 and 29.16 inches. The lowest depression occurred about 1 P. M. of the 24th, and probably indicated the nearest approach of the cyclonic axis, as it passed the ship. Its nearest approach to the *Supply*, at *Lew Chew*, appears to have been about 3 P. M. of the 22d, which is earlier by seventy hours. Hence, the rate of the advance of the cyclone, in this period, for the distance of little more than two hundred nautical miles, appears to be *only three nautical miles per hour*.

The earlier progress of this storm may have been at a faster rate, as has been shown in other cyclones, while moving westward toward the places of their northwardly recurvation. The minimum of the barometer, when properly observed, is believed to furnish more exact evidence of the actual progress of the storm than is afforded by the specific direction and changes of the winds, particularly in a wide spread cyclone.

The entire absence of any winds other than from the eastern board, with the several ships, would perhaps lead many navigators and meteorologists to infer that this gale was not a cyclone, but a direct wind, moving in the manner of a great current ; and such inference might seem confirmed, on finding that these conditions must have extended over a breadth of track equal to about ten degrees of latitude. Yet, we might well inquire whether any gales, *other than cyclones*, are ever found to blow with great strength on the broad ocean. But the characteristic movements of the barometer and the coincident changes in the direction and strength of the winds, as also the advanced action and the subsequent changes in the direction of the heavy swell, which often ran in a course different from the winds, as blowing at the several ships, are quite sufficient to establish the cyclonic character of this extensive and slowly advancing gale. Moreover, the direction and strength of the winds with the steamships on the 20th and 21st, was

such that, according to the above inference, the same should have reached the Caprice, and the coast of China, in about eight hours; and yet some fifty or sixty hours are found to have elapsed before this geographical translation had fully taken place.

Although the cyclonic character of this gale is thus fully established, we have still another important series of observations, obtained by the officers of the squadrom from the British schooner *Eament*, procured from the log-book by Lieut. Wm. L. Maury, which show us a portion of the northerly winds of the cyclone as *veering by the west* to southwest and south, in the *inner portion of its left hand quadrants*. The following is the abridged log, with the old system of nautical dates reduced to civil time:

The schooner *Eament*, H. D. Brown, commander, from Hong Kong towards Woo-sung, was standing through the Formosa channel, and on the afternoon of July 21, had moderate breezes from the northern quarter, with fine weather.

July 22 begins with light breezes from N.N.W. and fine; heading N.E. by N.; steady breeze and cloudy; 11 A. M., in all studding sails, and braced sharp up. At noon, latitude D. R. $25^{\circ} 30' N.$, longitude by chronometer $120^{\circ} 46' E.$; barometer 29.40. P. M., moderate breeze from N.N.W., and heavy sea from N.E. Midnight, pitching very heavily, and gale increasing; double reefed the foresail; barometer 29.39. [Off the north end of Formosa, heading up north-eastward, and approaching the center path of the storm.]

July 23.—1 A. M., gale still N.N.W.; split inner jib; vessel's course falling off from N.E. to E.N.E., and gale increasing; 10 A. M., Agincourt island bearing S.S.W., distant five miles. Noon, barometer 29.20; strong gale from N.N.E.; 4 P. M., gale increasing, close reefed foresail and mainsail; aneroid falling rapidly. Midnight, strong gale and heavy rain; aneroid 28.50; vessel pitching heavily. [Between Formosa and the Madjico-sima group.]

July 24.—1 A. M., blowing a hurricane from N.N.E., with high sea; at 11 A. M., split the foresail. At noon gale less violent; weather looking very unsettled; 1 P. M., wind W.N.W., and moderate, with dirty looking weather and high sea; aneroid 28.30, and still falling; at 3 P. M., calm! [Vessel on southern edge of the axial area of the cyclone.] At 3.30 P. M. wind increasing, and bearing to S.W.; vessel labors heavily; 5 P. M., gale S.S.W.; 5.30, blowing a hurricane; split fore trysail; 6 P. M., hurricane from south, increasing; scudding under bare poles; very heavy seas; aneroid 28.14. [Vessel behind the storm's centre, and running across the rear of the vortex.] At 7 P. M., gale S.S.E.; 8 P. M., hove-to under bare poles; gale S.E. At 10 P. M., less wind, with heavy rain; set fore staysail and the close reefed fore and mainsails; midnight, strong gale.

July 25.—4 A. M., less wind; aneroid rising; 8 A. M., strong wind and high sea; 9.30, shipped a heavy sea; split foresail; vessel heading N.E. at noon, with strong gale and heavy sea; aneroid 28.00 [?] and [barometer?] 29.51; P. M., gale strong from S.E., and thick weather; vessel running N.E.; rolling and pitching heavily; 6 P. M., strong breezes and thick weather; aneroid 29.40; midnight, same winds and weather.

July 26.—At 4 A. M., less wind; set foresail, close reefed; 8 A. M., set squaresail; course N.; rolling heavily. Noon, strong breezes, with heavy sea; aneroid 29.52; P. M., fresh gale from S.E., and heavy sea; 7 P. M., strong winds and dirty weather; double reefed the foresail; midnight, less wind.

July 27.—4 A. M., fresh breezes and squally; course W.N.W. At 9.30 A. M., saw Video, bearing W.N.W. $\frac{1}{2} N.$, distant 8 miles. [Position of this island, latitude $30^{\circ} 07'$, longitude $122^{\circ} 46' E.$] At noon, aneroid 29.63.

It is here seen that in the Formosa channel the cyclonic wind had set in on the 21st, settling to N.N.W. at midnight, at the distance perhaps of 90 miles *to the left* of the line on which the axis of the storm was approaching; but pushing northeastward, in order to clear Formosa and the small islands, the vessel was steered almost directly for the approaching vortex, and thus changed her wind from N.N.W. to N.N.E., the proper anterior wind on the path of the gale's axis. When this axis had passed the vessel, she was then enabled to run on her desired course, before the southwesterly and southerly winds, thus crossing the axis path into the second right hand quadrant of the gale, and thus bringing the wind to the southeast quarter.

The axis path of the gale, as indicated by the foregoing reports, is found on the annexed storm chart for the north Pacific ocean, marked (A).

To what limits this cyclone might be traced on the left or southerly side of its path we are unable to determine. In regard to the entire breadth of its path, it appears by the report of sailingmaster Conover, "that on 26th and 27th of July, it blew most terribly upon the coast from Hong Kong to Shanghai; scattering and wrecking the unwieldy Chinese junks, and sending many a poor fisherman to his long home." Its further course over the great alluvial plain of China and the adjacent waters of the Yellow Sea, and the subsequent recurvation of its path to the northward and eastward, are not likely to be determined by direct observations.

The phenomena of this great cyclone are fruitful of instruction, both to mariners and meteorologists, and present many points of practical interest, which cannot be dwelt upon in the limits of this communication. It may be noticed, however, without regard to the slow rate of progression, that the phases of the barometer and winds which were presented in the extensive region on the right side of the axis path, are in perfect accordance with those which are found in the right hand quadrants of the great cyclones which so often sweep over the United States and the north Atlantic ocean, in pursuing their northeasterly course. Thus, as we have already seen, during the W.N.W. progression in the lower latitudes, the true winds of the cyclone, in its two right hand quadrants are chiefly from the *eastern* board, and veering *to the right* towards the south in the progress of the storm; and on reaching the higher latitudes, in consequence of the inversion in the course of progression, the winds of these two right hand quadrants come mostly from the *western* board, and are still found veering *towards the right*, by west towards the north, as the cyclone moves onward over the places of observation. Such cases are constantly presented during the greater part of the year; and our navigators in crossing the Atlantic have great experience of the truth of this position.

CYCLONES AND MONSOONS.

It is doubtless important that the nautical reports which we have already noticed should become available for the better guidance and security of oceanic commerce. For it often happens that seamen are too slow in recognizing the cyclonic character and conditions of the gales which they encounter, and many disasters have resulted from this neglect.

In the Asiatic seas, as elsewhere, the judgment of the navigator is often misguided by the loose and inaccurate statements which are found in various authorities. Thus, it is said that gales or hurricanes rarely occur in these seas, except at the equinoxes, or at the changes of the monsoons. These assumed axioms are greatly erroneous, as the inspection of the storm charts may suffice to show.

The actual relations of the cyclones to the monsoons and local winds of the Asiatic seas are of much interest, and merit a careful examination. It is quite remarkable that these monsoons

should be found to have little, if any, control or influence as regards the regular courses and developments of the cyclones. This may show the predominancy of cosmical laws and influences over the apparently opposing conditions which are so extensively presented by these alternating winds.

The extent of the westerly monsoons, parallel to and on both sides of the equator, appears to be far greater than has been recognized by most writers. In the northern hemisphere these counter winds of the true trades extend from the east coast of Africa, near longitude 45° E., to at least longitude 175° E., in the central Pacific. The proper trade wind appears to consist of a comparatively thin stratum of aerial current moving upon the ocean surface, and is distinguished by its inclination towards the equator. On this stratum there is ordinarily imposed another current, probably of greater depth and volume, into which the trade wind ultimately merges, and which also moves westward while in the trade-wind latitudes, but generally inclines from the equator, as is shown by the rain clouds and squalls which it carries, and by the direction of translation imparted to the cyclones which it embodies. This important wind-current, so little recognized by most writers, frequently alternates with, or displaces, the true trades; and still more frequently it replaces the westerly monsoon, as a surface wind, to the east of Sumatra. Thus, the "southwest monsoon" of the China sea and the western Pacific, and which extends to the shores of Japan, is very commonly displaced from the surface by the main current of southeasterly wind, especially to the eastward of Sumatra. Thus, the "southwest monsoon" of the China sea and the western Pacific, and which extends to the shores of Japan, is very often displaced from the surface by the subsidence of the main current of southeasterly wind, more especially in the regions near the Asiatic coast.

UNIVERSALITY OF THE LAW OF STORMS.

The law of rotation and progression in storms, as developed on the Atlantic ocean, which was substantially discovered by the present writer in September of the year 1821, is essentially cosmical or world-wide in its origin and application. This soon became apparent in examining the accounts of gales which are found in the voyages of Cook, Vancouver, and others, in the several oceans and climatory zones of our globe. Hence, the polar relations of the phenomena presented are necessarily changed in the southern hemisphere, where, in all our relative comparisons, south must be substituted for north; east and west remaining the same.

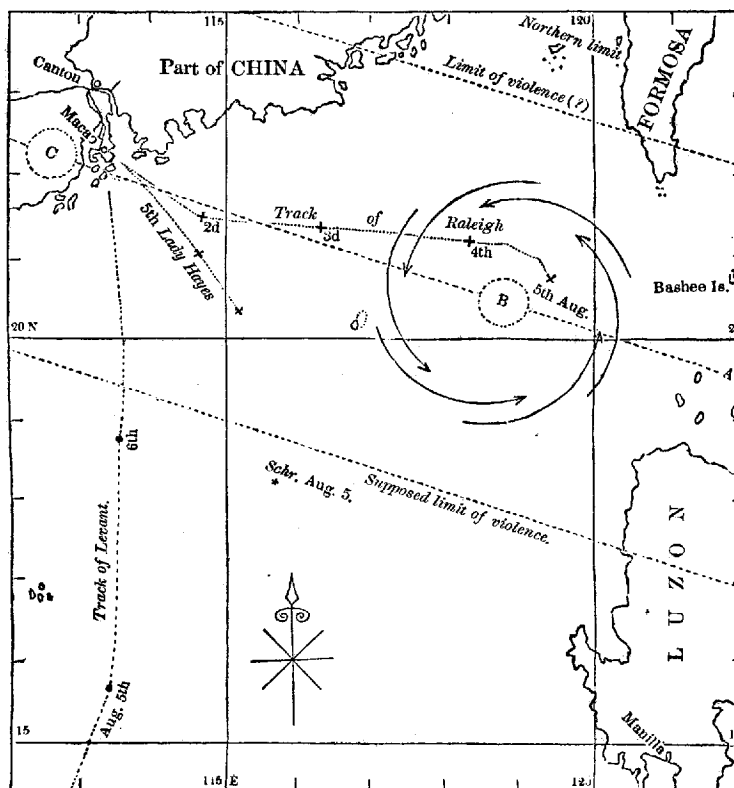
This similarity of polar relations in the winds of the two hemispheres, and the corresponding influence on the barometer, which are shown by the opposite cyclonic changes of these winds, are virtually recognized in P. P. King's account of his surveying expedition in the southern hemisphere about the year 1826, as is seen in his sailing directions. The more complete and satisfactory evidence of this cosmical system, or law, of cyclonic action, which is derived from a series of extended geographical observations in the paths of storms in the southern hemisphere, has since been furnished in the several works of Reid, Thom, and Piddington. The latter author has also investigated many storms of the sea of Bengal and the Indian ocean, and has noticed various gales, or typhoons, of the China sea. Some of the following notices may serve to increase our knowledge of Asiatic storms, and those of the Pacific ocean, north of the equator:

CYCLONES OF THE CHINA SEA.

A cyclone of moderate intensity was experienced by the *Mississippi*, then flag-ship of the expedition, from the 2d to the 4th of August, 1854, in the harbor of Cum-sing-moon, near

Macao. The wind was from N.E., veering through E. to S.E., S., and S.S.W. Barometer at lowest, 29.26 inches, on the 3d. These phases of the wind show the ship to have been under the two right-hand quadrants of the cyclone.

I have placed on the chart the track of a cyclone encountered by the American ship Panama in the China sea in October, 1831, which storm had previously passed over the Philippine Islands, and was very destructive at Manila. Also, the track of the cyclone of her Majesty's ship Raleigh, encountered near the Bashee Islands in August, 1835, and which afterwards visited Macao and Canton with great violence. A sketch showing its path of progression on the 5th and 6th of August is here subjoined.



It appears from the ship's log-book, as published by Colonel Reid, that the Raleigh sailed from Macao Roads on the 1st of August, on the track shown in our sketch, which had been prepared before the publication of his work. On the 4th the ship met with northeasterly and northerly winds, accompanying a fall of the barometer, and which increased to a heavy typhoon from N.N.E., veering to N.E. and E.N.E. Barometer at 8 A. M., 29.60; noon, 29.45; 8 P. M., 29.36; and midnight, 29.04, with typhoon increasing. August 5, at 3 A. M., the typhoon had veered to E.S.E., still increasing in violence; barometer 28.50, and falling. At 5 A. M., typhoon blowing from S.E. At 6.30, barometer falling from 28.30 to 28.20; commenced throwing the guns and shot overboard. At 8 A. M., still increasing. At 9.30 A. M. the ship went over. At 9.30 the masts and bowsprit went by the board and the ship righted, with four feet water in the hold; latitude $20^{\circ} 44'$, longitude $119^{\circ} 18' E$.

It will be seen by the veering of the wind that the Raleigh was on the right side, which is here the northerly side, of the center-path of the cyclone, and was very near to the vortex of the gale when it passed the ship, as is shown by the great fall of the barometer and the intensity

of the storm at that period. At 1 P. M. of the 5th the typhoon was blowing from S.S.E., and had moderated a little. From 6 to 7 P. M., more moderate; but strong gusts of wind, with a heavy sea, from the southward.

At Macao the typhoon was experienced in great force eighteen to twenty hours *later* than with the Raleigh. Of a valuable series of observations, thirty-four in number, which were taken of the barometer at Macao during the passage of the cyclone, the lowest was 28.08 inches, at 1.20 A. M. of the 6th of August. This great depression shows the centre, or vortex, of the cyclone to have passed near to Macao.

At Canton, on the right of the center-path, and about sixty miles north of Macao, the gale began with northerly winds on the evening of the 5th, and continued through the night and the next day. Its violence is said to have been greatest about 2 A. M. of the 6th. At midnight of the 5th the barometer had fallen to 29.37 inches. Its further fall, later in the night, was unnoticed; but at 5 A. M. it had again risen to 29.34 inches, which, respectively, is 0.23 inches and 0.32 inches higher than the two corresponding observations at Macao. The wind, during the typhoon, veered from N., through N.E., to S.E., and at 8 A. M. of the 7th the barometer had risen to 29.94 inches.

The American ship *Lady Hayes* left Macao Roads before the gale set in, and first encountered it about thirty-five miles from land, being on the *left* side of the line pursued by the storm's center. An attempt was made to return to port; which having failed, the ship, from noon of the 5th, was run off S.E. by E. under all the sail she would bear, and thus was meeting the gale in its approach, the wind then blowing at north, with a tremendous swell from the eastward. At 4 P. M. it was blowing in severe gusts, and the ship was becoming unmanageable. About 8.30 P. M. the wind began to veer to the west, but continued to blow as hard as ever till midnight, and drew round to the south, when it moderated a little. It continued to blow hard from that quarter until noon of the 6th. Had the wind veered eastward, as with the Raleigh and at Canton, it is likely the ship would have been driven ashore among the islands.

A three-masted schooner encountered the gale on the 5th of August in latitude $18^{\circ} 2' N.$, longitude $115^{\circ} 50' E.$, but no particulars are given.

Captain Dumaresq, of the American ship *Levant*, arrived at Lintin on the 7th, having made a fine run from the southward under the later and more outward winds of the cyclone, which had veered from S.W. by W. on the 5th to S.S.W. and S. on the 6th, with strong breezes, heavy squalls, and rain—ending in fine weather. At 11 A. M. of 6th had heavy squalls, with rain in torrents. Took in all studding sails, royals, and topgallant sails, and double-reefed the topsails, partly from an apprehension of falling too near the land the following night. The track of the *Levant* is seen on the sketch, as obtained from the ship's log-book and the private journal of Captain Dumaresq, which he has kindly placed in my hands.

From the data to which I have now alluded, the course of this storm appears to have been $N. 72^{\circ} W.$, and its rate of progress is estimated at about seventeen nautical miles per hour. It is fully apparent that its axis of rotation passed to the northward of the *Lady Hayes*, and southward of the Raleigh and of Canton, and the anchorages near Macao, and nearly on the line A B C, as designated on the sketch.

If circles, having a radius equal to about one hundred and sixty nautical miles, be drawn around the two points B and C, these will severally comprise the areas of principal violence in this hurricane at the two periods of 9 A. M. of the 5th and 2 A. M. of the 6th of August, respec-

tively. But the more moderate forces of the cyclone must have extended very far beyond these approximate limits.

A more extended notice of this storm may be found in my communications to the American Journal of Science, and the London Nautical Magazine, published in January, 1839, in which I have also comprised accounts of various other cyclones of great violence which have passed over the China sea, and the regions near Canton and Formosa, in different years. The tracts of some of these are well illustrated by the typhoon of the Raleigh. I omit, therefore, the close grouping which their delineation would require on the chart.

On the southern coast of China the semi-annual changes of the monsoons are found to occur in April, and about the end of September, varying somewhat in different years. Typhoons often cross the China sea, more commonly from May to October, on routes corresponding in direction to those of the hurricanes of the West Indies and the lower latitudes of the Atlantic, and with like characteristics. That inquiring old voyager, Dampier, states that on the coast of Tonquin the typhoons are expected in the months of July, August, and September. It will be noticed that these are also deemed to be hurricane months in the lower latitudes of the Atlantic, east of Yucatan, and that no special connexion with the periods of change in the monsoons is indicated. Dampier says that in these typhoons "the wind comes on fierce, and blows very violent at N.E. twelve hours, more or less. When the wind begins to abate, it dies away suddenly, and falling flat calm, it continues so an hour, more or less, when the wind comes about to the S.W., and it blows and rains as fierce from thence as it did before from the N.E., and as long." A better description of the phenomena of a violent cyclone, on its centre path in the lower latitudes, and before its recurvation, could hardly be given.

CYCLONE OF THE ANNIE BUCKMAN, IN FEBRUARY, 1853.

Among the valuable collections of the Expedition is an extract from the log of the American barque Annie Buckman, Henry Barber, commander, and furnished by him to Lieutenant William L. Maury. It will aid in dispelling the error that typhoons and hurricanes are only periodical in their occurrence in the torrid zone.

At noon of February 3, 1853, the Annie Buckman, sailing for Canton, was in latitude $12^{\circ} 30'$ N., longitude $129^{\circ} 16'$ E., several degrees east of the Philippine islands, with the barometer at 29.75, and a double-reefed topsail breeze from the N.E. quarter. In the period between this date and the 9th the vessel was subject to a very violent typhoon, during which both the direction of the wind and the course of the vessel went round the compass, by the north, west, and south, to the N.E. quarter on the 9th. At noon of this day the barque was in latitude $18^{\circ} 09'$ N., longitude $127^{\circ} 25'$ E., barometer 29.80. Of the few entries given of the barometer the lowest was 29.25, at 4 p. m. of February 7th; wind then from the westward, and increasing soon after to its greatest violence.

Captain Barber states that in twenty years navigation, in all oceans, he had not encountered a hurricane so violent. Its path is indicated on the chart.

Bonin Islands.—These islands, according to Commander Hammet, of H. M. ship *Serpent*, are subject to typhoons, but he states they are not frequent.

In October, 1853, the United States ship *Plymouth*, belonging to the Japan Expedition, was lying in Lloyd's Harbor, where on the 25th she encountered a typhoon, in which an officer and a boat's crew, then absent from the ship, were lost. According to the report of the acting master to Commodore Perry, it commenced with squalls of wind from E.S.E., under which the

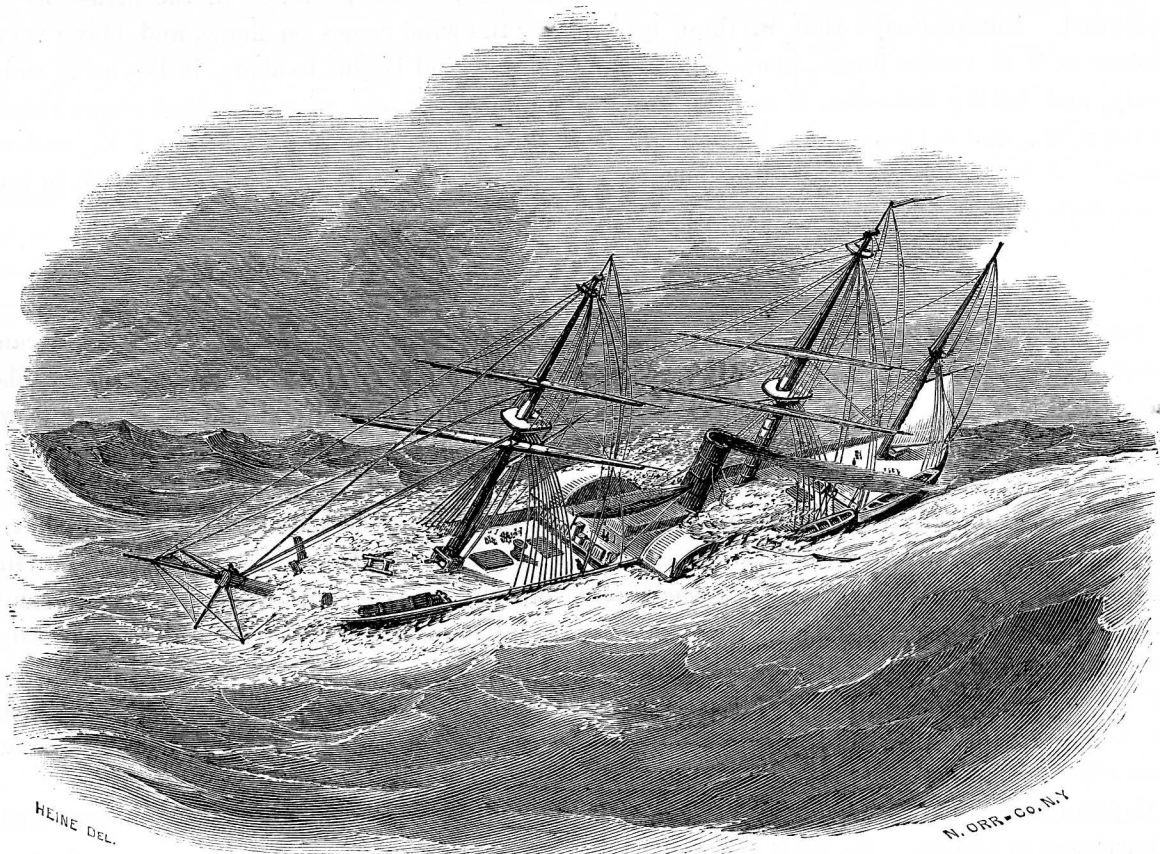
barometer began to fall. "At 9 p. m. it fell calm, and continued so for little less than an hour, when the wind came out again suddenly from the N.W., with terrific violence, blowing, if anything, still harder than from the E.S.E. Barometer, when lowest, 28.97, at which it arrived very rapidly, and when it commenced rising it did so in the same manner."

The position of Lloyd's Harbor (Peel's Island) is in latitude $27^{\circ} 05' N.$, longitude $142^{\circ} 16' E.$; and the above report affords data for approximating its route on the chart. This cyclone evidently completed its recurvation while passing over the Bonin Islands.

CYCLONE OF THE MISSISSIPPI.

Some observations, made in a storm-path of the North Pacific ocean, are afforded by the log-books of the ships *Mississippi* and *Southampton*, while on their return from Japan to the Sandwich Islands, and by other reports which have been obtained.

These two ships of the squadron left Simoda on the 1st of October, 1854, and throughout the 2d they encountered a swell from the S.E. On the 7th, when near latitude $36^{\circ} N.$, they were overtaken by a cyclone, which increased with the *Mississippi* to the force of a hurricane.



"MISSISSIPPI," OCTOBER 7, 1854.

The *Southampton*, early on the 6th, had the wind eastward, force 4, and increasing to 6 at noon, with rain; latitude $35^{\circ} 28' N.$, longitude $146^{\circ} 43' E.$ At midnight the wind had veered to S.S.E., decreasing in force. On the 7th it had veered to S.S.W., moderate in force, and at 9 a. m. became variable in direction. At noon, latitude $37^{\circ} 08'$, longitude $147^{\circ} 55' E.$, the barometer was at its lowest point, and the wind had settled to a gale at N.W., which abated in

the evening. On the 8th wind westward, and moderate; latitude $37^{\circ} 37'$, longitude $152^{\circ} E.$, p. m., the wind again passed to N.W., increasing in force; weather cloudy, with rain. I have no report from this ship for the 5th and 9th.

The Mississippi, on the 5th, had the wind from N.E., veering to E.S.E.; its force varying between 4 and 6, and barometer falling from 30.11 to 30.04 at noon; latitude $34^{\circ} N.$, longitude $149^{\circ} E.$ On the 6th, the wind gradually went to S.S.E., latitude $35^{\circ} 21'$, longitude $151^{\circ} 33' E.$ At 9 p. m., the force of the gale had increased to 9; topsails close-reefed; barometer had gradually fallen from 30.02 to 29.71.

October 7.—During first twelve hours the gale blew from S.S.E., veering towards south; force, 7 to 8. "The square sails were taken in, and the ship hauled up to the S.E. to avoid the center of the typhoon, which was evidently approaching from the S.W." At noon, barometer had fallen to 29.39; gale increasing; latitude $35^{\circ} 59' N.$, longitude $153^{\circ} 47' E.$ At 1 p. m., gale S. by W. 10; barometer 29.29. 2 p. m., S.S.W. 11; barometer 29.17, being its lowest. 3 p. m., S.W. 12; barometer 29.21. From noon "until 4 p. m., the wind was blowing with the force of a hurricane, in puffs, flattening the sea, and filling the air with spoon-drift, subsiding then into a heavy gale." At 4 p. m., gale S.W. 11; barometer 29.27. 6 p. m., W.S.W. 10; barometer 29.45. 8 p. m., W. by S. 9; barometer 29.53. 10 p. m., west 7; barometer 29.60.

On the 8th, gale at W.S.W., abating its force, and from 9 a. m. inclining southerly. At noon barometer had risen to 29.71; latitude $35^{\circ} 30' N.$, longitude $155^{\circ} 11' E.$; p. m. the gale passed to N.W., with increasing force, 7 to 8; midnight, barometer 29.91.

October 9.—During first twelve hours the gale continued strong from N.W., 6 to 8, passing northward. Noon, barometer 30.16; latitude $35^{\circ} 40' N.$, longitude $157^{\circ} 59' E.$ At 8 p. m. the barometer reached its maximum, 30.30; wind wound to N.E. quarter; force, 6; which abated on the 10th to an ordinary breeze.

It is here apparent that both vessels were successively under the two right-hand quadrants of the cyclone. It is alike obvious that the Southampton was nearer to its axis-path than the Mississippi, and yet had far less of its violence. This may, in part, be accounted for by the greatly dilated and weakened condition of the interior portions of the cyclone. This dilated condition is very common in the great cyclones while passing through the temperate latitudes, and may have its chief origin in the region where the recurvation of the storm-path occurs. For, in the change of course at this period, the winds of the eastern part of the cyclone have a much earlier and shorter transit into the now inverted path of the temperate latitudes than the cyclonic winds of its westerly side, which left to pursue a wider circuit.

On the 23d of October the Mississippi arrived at the Sandwich Islands, where an account of this "typhoon" was at that time published. While at these islands, an extract was procured, by Lieutenant William L. Maury, from the log-book of the American whale-ship George Howland, which vessel encountered the gale near latitude $46^{\circ} N.$, which there set in on the morning of the 8th. See as follows:

Friday, October 6.—Moderate breezes from N.W.; course E. by S.; latter part fresh from W.N.W.; latitude $46^{\circ} 29'$, longitude $161^{\circ} 09' E.$

October 7.—Wind fresh from W.N.W.; latter part moderate breezes; latitude $45^{\circ} 46' N.$, longitude $164^{\circ} 43' E.$ [This, apparently, is the ending of a previous cyclone.]

October 8.—Moderate breeze W.S.W.; course E. $\frac{1}{2}$ S. At 8 a. m., the wind hauled to S.S.W., and increased to a gale; latitude $46^{\circ} 18' N.$, longitude $165^{\circ} 50' E.$ At 4 p. m., wind east, [E.S.E.,

true,] and a heavy gale. At 9 p. m., died away suddenly, and came down from S.W.; course E. by S.

October 9.—Gale moderate from S.W. by W.; at 7 a. m., hove-to; middle part, wind W., with a heavy cross sea. At 4 p. m., kept off E. by S.; latitude $45^{\circ} 40'$ N., longitude $169^{\circ} 45'$ E.

October 10.—Gale fresh from N.W., [noon;] wind moderate, W. by N.; latitude $44^{\circ} 36'$ N., longitude $173^{\circ} 20'$ E.

This further trace of the cyclone increased the desire for observations from the earlier portions of its path in the lower latitudes, but which seemed unattainable. Fortunately, the London Nautical Magazine, for February, 1855, contains the following report from P. Briard, commander of the brig Giffard, addressed to the editor:

“CYCLONE IN THE PACIFIC OCEAN.

“SIR: I forward you an abstract from the log of the brig Giffard during a severe typhoon, experienced on her passage from San Francisco to Shanghai, which will help to investigate the track of cyclones in that part of the Pacific ocean.

“Tuesday, October 3, 1854.—Latitude at noon, $25^{\circ} 32'$ N., longitude $137^{\circ} 48'$ E.; fresh breezes from N.E.; hazy weather; a dense bank of clouds in the east; barometer fluctuating between 29.70 and 29.80. At midnight freshening breeze, with squalls and rainy weather; ship heading N.W. by N.

“October 4.—Increasing gales, with squalls and thick, rainy weather; double-reefed topsails; furling jib and mainsail. Noon, latitude 27.40 N., longitude $134^{\circ} 10'$ E.; barometer 29.60. At 1 p. m., barometer fell to 29.35; gale increasing, with incessant rain. I begin to suspect we are edging gradually in a typhoon, the winds being east, and our course W.N.W.; consequently, being on the northern edge of it, I decided on heaving to, to allow the center of the cyclone to pass on ahead; sent down royal yards, furling the courses and foretopsail, and brought the vessel to under close-reefed maintopsail on starboard tack; wind east; ship's head N.N.E. At 4 p. m., barometer 29.30; at midnight, barometer 29.25; wind E.S.E.

“October 5, a. m.—Blowing a severe gale, with incessant rain; lying to under close-reef maintopsail. At 4 a. m., barometer 29.20; wind S.E.; at 8 a. m., barometer 29.15; wind S.S.E.; at noon, barometer 29.05; wind S.S.E.; at 2 p. m., barometer 29.00; wind S. by E., blowing a furious typhoon, with incessant rain; the sea a complete sheet of foam, flying over the ship. At 4 p. m., barometer 28.80; wind south; at 8 p. m., barometer 28.70; wind S.S.W.; were struck by a sea on the starboard bow. This, combined with the strength of the wind, which was now at its height, carried away the bowsprit, foremast, close to the deck, and maintopmast, leaving nothing but the mainmast standing, and shifted the ballast, giving the vessel a heavy list to port. At midnight, barometer 28.70; wind S.W.; no abatement in the fury of the gale.

“October 6.—At 1 a. m. the barometer began to rise; at 2 a. m., barometer 28.90; wind W.S.W., moderating a little; still raining incessantly. At 4 a. m., barometer 29.00; wind W. by S.; at 8 a. m., barometer 29.10; wind W. by S.; at noon, barometer 29.30; wind west; moderating fast, but still blowing a heavy gale. My impression is, that on the 4th the cyclone was travelling N.W., but that on the 5th it recurved to north, as we had the heaviest of it when the center bore N.W.

“I remain, &c.,

“P. BRIARD.”

We have thus, from Captain Briard, a good account of this cyclone previous to and at the time of its recurvation. On comparing the several reports with those of the previous great cyclone of July, 1853, and in view of other analogies, I am led to believe that the swell from southeast, reported by the ships on the 2d of October, on the Japan coast, is referable to the action of the right border of the cyclone, while passing westward in the lower latitudes.

If we add to the observed track of the cyclone the diameter of its area from the places of the earliest and latest observations, respectively, we may consider its known path as extending more than four thousand nautical miles.

The rate of its advance from the probable position of its center on the 3d to that of the 4th of October I estimate at about seventeen nautical miles per hour; from the 4th to 5th at ten or twelve miles per hour, and from 7th to 9th at about forty miles per hour.

The observations made on board the *Mississippi* furnish the best data for estimating the probable diameter of the cyclone as it passed over the skip. The time thus occupied in the barometrical transit may be reckoned from noon of 5th to about noon of 9th—a period of ninety-six hours. If we allow an average rate of twenty-five miles an hour for the progression at this period, and deduct the corresponding advance of the vessel, it will indicate a diameter of the cyclonic influence of nearly two thousand miles; but, as the extreme right border of such a cyclone does not commonly increase its latitude in those parallels, we may estimate the extent of its moderate activity on the 7th as equal to about fifteen hundred miles, or perhaps greater.

The approximate track of the cyclonic axis, as deduced from the observations, will be seen on the chart.

Since writing the above, I have received from the British Admiralty, through the kindness of Captain A. B. Beecher, the observations made during the period of the cyclone on board her Majesty's ship *Winchester*, then lying in the roads of Nagasaki, in latitude $32^{\circ} 44'$ N., longitude $129^{\circ} 46'$ E. At this position, situated nearly three hundred miles northwestward from the nearest part of the axis line on the chart, with the great island of Kiusiu intervening, the earliest indications of the cyclone were from midnight of 4th and 5th of October, at which hour the weather was calm, and the barometer 30.05. During the first twelve hours of 5th the barometer fell to 29.88, with wind veering from E.N.E. to N.E.; force 4 to 3, with squally weather. In the afternoon of 5th the wind had veered to north, and the barometer fell to 29.80, near which it continued during the night and throughout the 6th, with wind nearly at north, but diminishing; its force varying from 4 to 2, but with a calm at 8 P. M. of 6th. In the morning of 7th the wind came from N.N.W.; force .3; and at noon the barometer had risen to 29.97—reaching a maximum of 30.06 in the following night.

This account shows the general accuracy of the recurvation which has been assigned to the track. It exhibits a cyclonic depression of about one-fourth of an inch in the barometer at Nagasaki, and a moderate exhibition of the cyclonic winds. The phenomena do not differ essentially from those of the corresponding border of cyclones in the United States in the like relative position.

REINDEER'S CYCLONE, JULY, 1850.

The American ship *Reindeer* was dismasted in a furious hurricane on the 19th of July, 1850, in latitude $18^{\circ} 30'$ N., longitude 139° E., about twelve hundred miles from the coast of China. She ran with bare poles under the easterly winds of the cyclone, thus nearing its vortex till the barometer had fallen to 28.85, when the wind veered to S. S. E. in a perfect blast; the ship broached to, and the masts soon went overboard.

With the knowledge of storms which we now possess, our ships should not be thus disabled in open sea.

THE FREAK'S TYPHOON, OF MAY, 1850.

The English brig *Freak*, T. B. Simpson, master, met with a cyclone on the first of May, 1850, in latitude $19^{\circ} 28' N.$, longitude $138^{\circ} 44' E.$, which set in at E. by S. and increased to a hurricane of great severity. During the remainder of that day the brig ran westward, with an increasing gale, which ranged between E. by S. and E. by N. At midnight, the master began to suspect that he was approaching the vortex of a cyclone that was travelling to the northwest, and at 1 A. M. of 2d, he hove to on the starboard tack to allow it to pass him. After heaving to, the wind continued steady at E. by N., and commenced blowing a hurricane, except with a partial remission, at 6 A. M. At noon the wind became E.N.E., with barometer at 29.22, near latitude $19^{\circ} 40'$, longitude $136^{\circ} 40' E.$ Had the strength of the cyclone between 2 and 3 P. M., when the fore-topmast and main-topgallant-mast were broken off by the force of the wind, which at this time was beyond description. At 3.50 P. M. barometer had fallen to 28.87—its lowest point. The wind from noon continued to haul *to the northward*—its greatest strength being from about N.E. by N., and the master thus found, to his surprise, that he was in the northwest quadrant of the cyclone and on the left side of its path, it having already recurved to the northward and eastward. From 4 P. M. the barometer began to rise and the force of the gale to decrease, and it became steady for a time at N.N.W.

The easterly winds of this cyclone having veered by the north, the master's inference, that the recurvation of its path took place during the time in which his vessel was exposed to the gale, appears correct—the center having recurved southward and eastward of the vessel's place. His full account may be found in the *Nautical Magazine* for 1851, pages 273–275.

Marian Islands.—The island of Guam, in latitude $13^{\circ} 26' N.$, longitude $144^{\circ} 52' E.$, and the other islands of the Ladrone or Mariana group, are understood to be subject to hurricanes, for which the inhabitants prepare by lashing down and securing their houses. They are expected in the months of June, July, and August; also, in December and January.—*Nautical Magazine*, 1843, p. 6.

[The delay of the press enables me to state here that Guam was visited on the 23d of September last [1855] by a typhoon of the most violent character. The account states that "the storm commenced in the morning and kept on increasing until 11 P. M., when it burst upon the place with all its power. No tongue can tell nor pen describe the perils of that night. In less than twenty minutes more than eight thousand persons were left without a house or roof to protect them from the fury of the storm.

"All the houses upon the island of Guam, with the exception of ten or twelve stone buildings, were destroyed and scattered in every direction. The rain fell in torrents, and, as it touched the lips, it tasted as salt as though it came from the ocean. Thousands of cocoa-nut trees, (which is a very tough wood,) laden with fruit, were crushed like so many slender reeds, torn up by the roots and thrown into all shapes. Nearly everything that carried its head above ground was destroyed."]

CYCLONE OF THE J. N. GOSLER, MAY, 1855.

The American ship *J. N. Gosler*, from San Francisco, for Hong Kong, experienced a heavy typhoon on the 28th of May, 1855, in latitude $16^{\circ} 40' N.$, longitude $147^{\circ} 45' E.$, nearly two thousand miles from the Chinese coast. She carried away sails, spars, &c., and was abandoned

on the 30th, with nine feet of water in the hold. The officers and crew succeeded in reaching the Marian Islands in their boats.

STRONG'S ISLAND, AND ASCENSION.

Mr. John T. Gulick, of the Sandwich Islands, in the year 1852, visited several of the Micronesian Islands, near the equator, in company with the missionaries who then settled at these islands. At Strong's island (Ualan,) in latitude $5^{\circ} 12'$ N., longitude 163° E., they were informed by King George, the principal chief, that at a former period the island had been visited by a hurricane which wholly destroyed the bread fruit trees, and thus caused a famine which destroyed a large portion of the inhabitants. He described the gale as blowing first from one quarter of the heavens, and then from another.

At Ascension island (Bonabi,) which is about three hundred miles distant, in a west-northwest direction, a similar account was received. Although it cannot be certainly known that the disasters at the two islands were produced by one and the same storm, yet their relative positions accord with the usual course of progression in the lower latitudes. A cyclone moving on this track, would be likely to cross the China sea, unless prevented by an earlier recurvation of its path into the temperate latitudes.

CYCLONE OF THE AUSTERLITZ; NOVEMBER 1851.

The following notices of this cyclone are contained in letters from Hong Kong, dated December 18, 1851, and made public by the secretary of the New York Board of Underwriters :

"The new clipper Witchcraft arrived at Hong Kong on the 3d of December, from California, with loss of mainmast head and all the topmasts. She experienced a typhoon on the 13th-14th of November, in latitude $22^{\circ} 40'$ N., longitude 150° E."

"About the same period, in latitude $19^{\circ} 48'$ N., longitude 159° E., the American ship Austerlitz was totally dismasted. The chain-plates were torn from her sides, and her hull otherwise much injured. The N. B. Palmer, bound from San Francisco to Shanghai, fell in with her and took from the wreck all on board, and abandoned her."

It cannot be doubted that the two ships, Austerlitz and Witchcraft, fell, successively, nearly into the heart of the cyclone. We have thus two points established in its track, which are distant from each other about five hundred and thirty nautical miles. These positions show its course to have been north 71° west, or W.N.W., nearly. The want of an exact date in the account of the Austerlitz, leaves the rate of progression undetermined. The position of the Austerlitz is more than two thousand five hundred miles from Hong Kong, on the coast of China, and is somewhat nearer to the Sandwich Islands.

I have been informed recently by Captain Rodgers, who commanded the Witchcraft, that he left San Francisco on the 3d of October, and had light, variable winds and calms to the Sandwich Islands. After passing these islands, he found very unsteady winds, veering from N.E. to S.E., and sometimes S.W., with occasional light airs from west; the barometer ranging from 30 to 30.05. In longitude 169° E., the winds veered to S. and S.W., with heavy clouds and swell from westward; barometer ranging about 29.90, indicative of the S.W. monsoon. On reaching longitude $159^{\circ} 30'$ E., latitude 20° N., November 9th, he had a very heavy gale, of short duration, from S.W., veering by S. to S.E., in which his close-reefed topsails were blown away. Hence, he hardly expected the severe gale of the 14th, in the path of which he ran, on a west course, with increasing wind from S.E., veering to south, and finally to S.W. The ship was hove to,

with the wind at south ; and at no time was in advance of the center or axis of the cyclone. The barometer stood lowest, 29.20, about 8 A. M. of the 14th, at the time when the topmasts were blown away.

KINGSMILL ISLANDS, GILBERT ARCHIPELAGO.

These islands, situated on and near the equator, longitude about 175° E., were visited by the United States ship Peacock, of the exploring expedition under Captain Wilkes. Variable winds from the northward and westward prevail from October to April ; and they have violent gales from the southwest. According to Kirby, who was taken off the islands, these storms are typhoon-like, and last three or four days. The westerly sides of the islands receive most damage, and both land and trees are swept away.

THE RADACK ISLANDS.

These islands are scattered between 6° and 11° N., and longitude 168° to 173° E. Captain Kotzbuë ascertained that hurricanes of great violence sometimes occur in September and October, and the natives always anticipate with dread the recurrence of those months.

THE JAPAN'S TYPHOON.

In December, 1832, the Japan, a new ship, encountered a severe hurricane in latitude 13° N., longitude about 160° west.

This position is about on the meridian of the most western of the Sandwich Islands.

The tracks or paths of those cyclones, of which the dates and positions have been given, are indicated on the annexed chart.

SANDWICH ISLANDS.

At the Sandwich Islands, latitude 19° to 22° N., longitude 155° to 160° W., the cyclones which occur are, commonly, not of great severity ; although the native huts are sometimes unroofed or destroyed. The *kona*, or southerly wind, by which the trade wind during part of the year is much interrupted, may be referred, at least in part, to those cyclones which have their center-path northward of the islands, or which complete their recurvation in that region. The easterly gales which accord nearly with the trade winds in their direction, indicate an axis-path which lies southward of the islands. The actual presence or influence of a cyclone may, commonly, be determined by the oscillation of the barometer.

The absence of intense violence in any of the cyclones which visit this group of islands, may possibly be due to their geographical position. But it is equally probable that this qualified exemption may result from a diversion of the course of the central vortex of the cyclone, occasioned by the great height and compact form of Hawaii, the most southeastern of these islands. For the group lies in almost a direct line, which is parallel to the ordinary courses of the cyclones in the lower latitudes ; being, from the summit of Manua Kea to the centre of Kauai, north sixty-one degrees west. A cyclonic vortex, if moving previously on this line of direction, would be displaced by the eastern angle of Hawaii, which island has an area of near four thousand square miles, a portion of which rises far above the upper horizon of the cyclones, and at two points reaches an elevation of nearly fourteen thousand feet. The protection, or partial diversion of course thus occasioned, must extend in good measure to the high but smaller islands which lay in the same track.

CYCLONE OF THE LARK.

The American barque *Lark*, Tibbets, master, from Canton for Valparaiso, had a severe gale on the 23d of September, 1843, in latitude 15° N., longitude $138^{\circ} 40'$ W. Found it necessary to make a port after the gale, and put in at Tahiti.

It appears, also, that the *Lark* encountered a violent typhoon of an earlier date, when off the island of Formosa.

CYCLONES OF THE EASTERN PACIFIC.

In approaching the eastern border of the North Pacific ocean, in the lower latitudes, we fall into the track of the large and increasing trade to California, and a better knowledge is thus obtained of the cyclones in this region. Of these gales, the tracks of twelve, which will now be noticed, are partially indicated on the chart.

Track 1. The *Joseph Butler*, on or about the 24th of June, 1850, encountered a severe gale of wind near latitude 16° N., longitude 107° W., [260 miles from the shore of Mexico,] which carried away her mainmast. I have no further accounts of this gale.

Track 2. The barque *Como*, on the 5th of August, 1850, in latitude $14^{\circ} 20'$ N., longitude 117° W., encountered a severe gale, commencing at N., and veering to W. and S. Lost sails and bulwarks, and sustained much other damage. These winds denote a course of progression corresponding to that of the hurricanes in the West Indies, and that the vessel was in the left side of the storm-path.

Track 3. Niagara's Hurricane.—The *Niagara* was dismasted in a hurricane September 9, 1850, about ninety miles south of Acapulco, [latitude $15^{\circ} 16'$ N., longitude $99^{\circ} 50'$ W.]

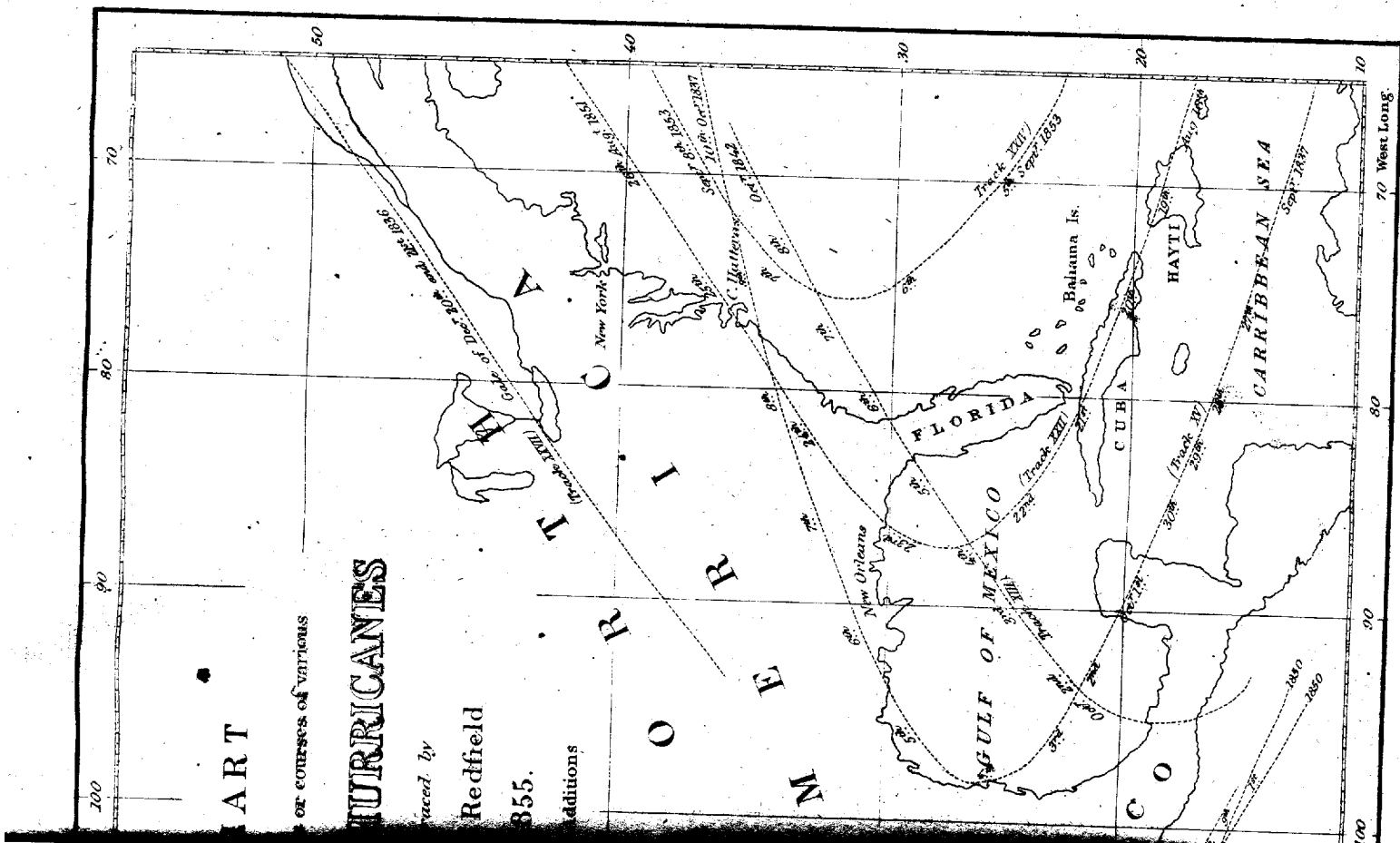
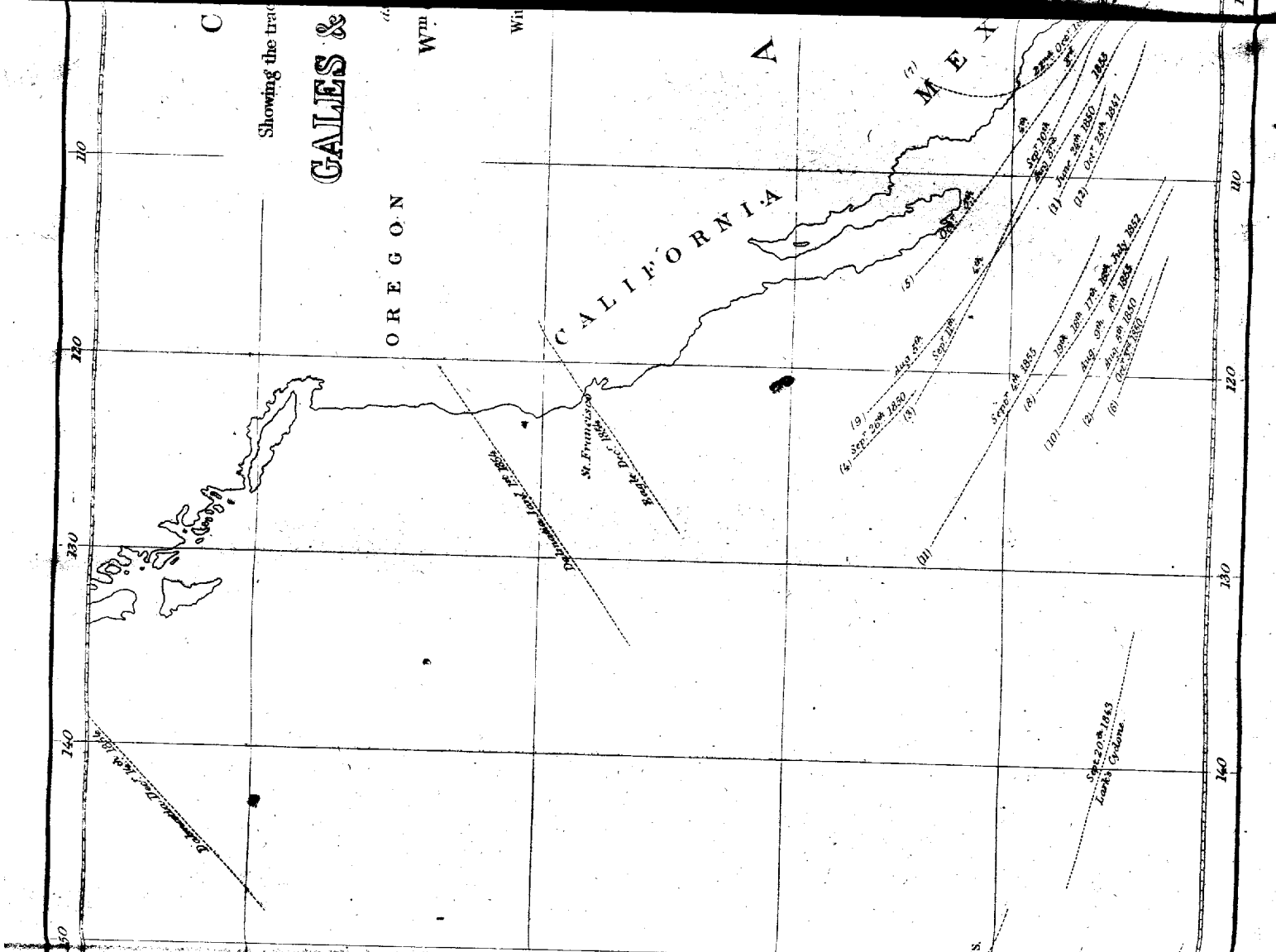
The *Diana*, September 11, latitude 22° N., longitude 116° W., had a severe hurricane from N.E., veering to S.W.; blew five hours; vessel hove on beam-ends.

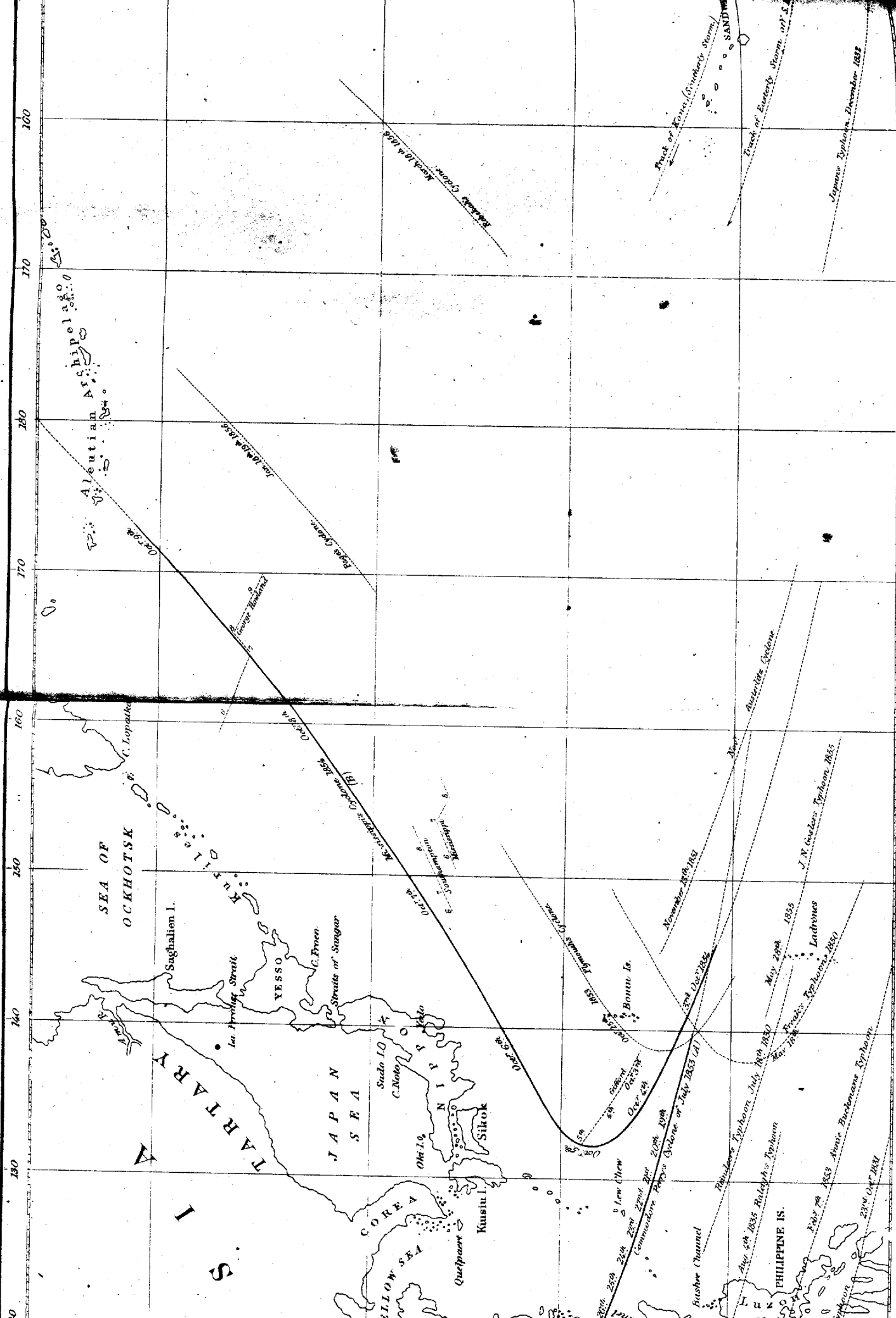
The *Diana's* position was in the left side of the storm-path, but near to the axis line, the progression of the storm being still northwesterly. Its course of progression from the *Niagara* was 34° N. of W., or N.W. by W. nearly. Its rate of progress was nearly twenty-three miles an hour, allowing no error for the nautical dates.

Track 4. The *Laura*, September 26, 1850, latitude 26° N., longitude 123° W., in a severe gale, was thrown on her beam-ends; lost cargo, &c. I have no further account of the progress of this gale.

Track 5. The *Kingston*, from San Francisco for Panama, experienced a severe gale on the Mexican coast, and was thrown on beam-ends, October 1, 1850, in latitude 14° N., and reports that the gale swept the whole coast with great violence, as may be seen in the succeeding statements.

The *Belgrade*, from San Francisco for Realejo, October 1, fine breeze from W.N.W., and heavy swell from S.E. At 10 P. M. wind hauled suddenly to S.E., with increased force and squally appearances; at midnight under single-reefed topsails; 1 A. M. still increasing, with vivid lightning and heavy rain; 4 A. M. split fore-topsail; 8 A. M. lost foresail; gale increasing to a hurricane; thrown on beam-ends, with loss of main and mizen-topmasts, with head of mainmast, when the ship righted a little. At 1 P. M., October 2, hurricane still increasing, ship on her beam-ends; lost fore-topmast, with much other damage; at midnight blowing as hard as ever; at 4 A. M., October 3, more moderate, heavy rain; October 4, latitude $18^{\circ} 11'$ N., longi-





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ALUTIAN ARCHIPELAGO

SEA OF OKHOTSK

ISLANDS

SAGHALIEN I.

YESSO

JAPAN SEA

COREA

YELLOW SEA

PHILIPPINE IS.

STRAITS OF SINGAPORE

YAMAGUCHI STRAIT

TSUGA STRAIT

OMI STRAIT

TSUGA STRAIT

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tude $104^{\circ} 5' W.$, made for Acapulco. It may be seen that this vessel was on the right of the axis path of the storm.

The *Galindo*, on the same route, experienced a severe hurricane on the 1st and 2d of October; was thrown on beam-ends and dismasted, and arrived at Acapulco at the same time with the *Belgrade*.

The *Lavina*, off Cape San Lucas, the southern point of California, October 5, was thrown on beam-ends in a violent hurricane, and lay twenty-one hours.

The *Fanny*, from Mazatlan, in the gulf of California, for San Francisco, was damaged in the gale on the 5th and 6th of October, and put back to Mazatlan.

The progress of this hurricane during four days appears to have been N.W. by W. nearly, at a rate not exceeding eight or ten miles an hour.

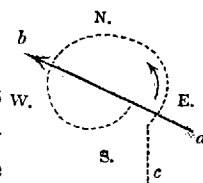
Track 6. Amazon's Hurricane.—The brig *Amazon*, from New York for San Francisco, encountered a severe hurricane October 3, 1850, in latitude $13^{\circ} 30' N.$, longitude $116^{\circ} 50' W.$, which commenced at S.W., veering successively to S.E., E., N., W., ending at S.W., in which lost main-topsail and foresail. Captain Watt states that the gale was equally severe as those in the West Indies. This off-shore hurricane was cotemporaneous with that last noticed. The following is drawn from the account which was published by a passenger of the *Amazon*.

October 4, latitude $13^{\circ} 40' N.$, longitude $116^{\circ} 30' W.$; last night the brig encountered a hurricane, preceded by squalls from S.W., with heavy rain. The squalls increased in number and intensity until 5 p. m., when the hurricane commenced; brig under close-reefed fore-topsail and mainsail. Captain Watts put his vessel before the blast, or "scudded" her. The tempest raged during the night, with momentarily increased fury. It veered from S.W. to due south, thence to S.E., and thence to N.E. and north, and from thence to S.W., thus making the circuit of the compass! According to our reckoning, it veered thirty-four points in the space of six hours, during which time the brig was kept before it, in which lay our only chance of escape. At 4 a. m. the foresail was blown from the yard, and the vessel was then brought to the wind, but could not withstand the tornado, and was blown directly down on her side, or beam-ends. Apprehending she would founder, the order was given to put her again before the wind, but the attempt was unsuccessful. As a last resource, the main-topsail was let go, when she paid off, and dashed away like lightning before the tempest. She was kept scudding until the hurricane abated, and was then laid to in a heavy gale from S.W., into which the hurricane subsided.

From the above we may infer that the course of the vessel while scudding was not unlike that shown in the annexed figure.

The short time in which the bring ran entirely around the axis of the gale, after entering its violent portion, shows that its diameter was small, and that its progression was remarkably slow. This slowness is also shown by the manner in which the brig, steering N. for San Francisco, was able to overtake the cyclone, and run into it, upon its southeastern side, where its wind was southwesterly. Hence, too, after clearing the vortex of the cyclone, and heaving to, the duration of the exterior portion of the gale was so much prolonged, notwithstanding the drift of the vessel was in a direction opposite to the progression of the storm. It is probable that this progression did not exceed four miles an hour, and it may have been less.

This is a slower rate of advance than I have yet found on the Atlantic; but it accords well with other cases which have occurred within the tropics, in the Indian ocean. It appears, also, as having some relation to the slow rate of advance, already noticed in the cotemporaneous



in-shore hurricane, of the *Kingston*. Hence we may infer that the great current of rotation in which the cyclones are imbedded was at this period and in this region, at least, comparatively sluggish and inactive. We have noticed a similar condition in the eastern Atlantic in the previous month, in the case of the Cape Verde hurricane, of Track 23.

Track 7. Captain Budd's gale, of October, 1851.—Capt. Budd's steamer from San Francisco, for Panama, was, on the 21st of October, in latitude $22^{\circ} 07'$, off Cape San Lucas. At daylight of 22d the wind was very high, hauling to S.E., preceded by a heavy swell from the same quarter. The gale blew heavy from S.E., and then commenced hauling to N.E., and blew still more heavy; barometer 29.75. He had now crossed the entrance of the Gulf of California, to within sixty miles of Cape Corientes. At 4 p. m. gale abating, and hauling to the westward, going round by the north.

The winds in this case appear to indicate that Captain Budd fell under the right hand or northern side of the gale as it first approached, and that the gale recurvated northward upon the contiguous portion of Mexico before the axis of the storm had reached the position of the ship.

Track 8. Panama's gale, of July, 1852.—The *Panama* experienced a hurricane, July 16, 1852, in latitude 15° N., longitude 115° W., which lasted ten hours; carried away top-gallant-masts, yards, sails, &c.

Extract from logbook of ship *Empire*, bound for San Francisco:

July 19, 1852, commences with heavy gales and bad sea from the north; under double-reefed topsails and courses. [Ship in front part of the gale, to the left of its axis path.] At 8 p. m. heavy gale from N.N.W.; at 10 p. m. very heavy gale; hove the ship to under triple-reefed main-topsail; midnight, gale increased to a hurricane; the mainmast went by the board, together with the mizenmast, fore-top-gallant-mast, &c., with everything attached; blowing a complete typhoon. At 5 a. m. succeeded in clearing the wreck; at 7 a. m. gale had in some measure abated, at 8 a. m. got the ship before the wind, then blowing from S.S.W.; at noon of 20th, only a brisk gale from S.S.E.; latitude, by account, $17^{\circ} 4'$ N., longitude $117^{\circ} 35'$ W.

This could have been none other than the Panama's gale, moving on a course between 30° and 40° north of west, and, if there be no error in the Panama's date, at the rate only of about three miles and a half per hour!

This slowness of progression in the three hurricanes of the *Panama*, *Amazon*, and *Kingston*, is of great interest for navigators in the Pacific. For it shows how perfectly the exposure and safety of their vessels, during such hurricanes, are placed in their own control, at least in cases where sea room on all sides is afforded them. Thus, if the master of the *Amazon* had comprehended the character of his hurricane, or its law of rotation and progression, he might have run more eastward, and until the state of the barometer and winds would have allowed him to come up to his desired course. This would have enabled him to make a safe, rapid, and successful run towards his port of destination, while he kept in the outskirts of the gale.

The *Empire*, when headed off by the north wind in the front of the cyclone, could not pursue her course for San Francisco, nor safely heave-to on either tack. But she had opportunity to run southward in the beginning of the gale, keeping the wind on the starboard quarter until the state of the barometer and the diminished strength and westerly changes of the wind should enable her to turn eastward, around the rear of the hurricane, and thus regain her course with a fair wind.

These eight cases were noticed in the American Journal of Science, in 1854; but their relation to the storm chart, as well as their value to navigators, makes it proper that the condensed

statements should here be presented. The following notices of other cyclones in the eastern Pacific have since been obtained :

Track 9. The Belle's Cyclone.—The barque *Belle* was dismantled in a severe gale on the 3d of August, 1855, in latitude 18° N., longitude 109° W., while making her passage from Cape San Lucas to Honolulu. Her main and mizen masts being cut away, she righted, with five feet of water in the hold. At 11 o'clock the wind shifted suddenly to southwest, and she was again thrown on her beam ends. The foremast was cut away, and she again righted, sweeping the decks of everything.

It is clear that the *Belle* was on the center path of the cyclone.

The Dutch ship *Gertrude Maria*, sailed from San Francisco for Callao, July 26, and proceeded on her voyage very well until August 5, in latitude $23^{\circ} 53'$ N., longitude $118^{\circ} 47'$ W., when she experienced a severe hurricane from N.E. to N.N.W., W.N.W. and west to S.W. and south, which lasted to the 6th. During its continuance, lost main topmast, with everything attached.

If we compute the advance of the cyclone in two days, from the position of the *Belle* on the 3d to that here given on the 5th, as equal to six hundred and sixty nautical miles, it will show a rate of about thirteen and a half miles per hour, on a course which is north 58° west, or N.W. by W., nearly.

Track 10. Second Cyclone of the Gertrude Maria.—From the 8th to 9th of August, 1855, in latitude 15° N., longitude $116^{\circ} 31'$ W., the *Gertrude Maria* experienced another severe hurricane from N.E. to N.N.W., W.N.W. and west, to S.W. south and S.W., during which she lost fore-topmast, &c., and was compelled to put back to San Francisco to repair.

Track 11. Cyclone of the Edward Stanly.—The ship *Edward Stanly*, from Cardiff to San Francisco, September 4, 1855, in latitude 20° N., longitude $121^{\circ} 50'$ W., experienced a violent hurricane from S.E., which lasted eighteen hours; during which, shipped a heavy sea, and sustained much damage.

CYCLONE OF THE UNITED STATES SHIP PREBLE.

Track 12.—The United States ship-of-war *Preble*, from Monterey towards Callao, at noon of October 24, 1847, was in latitude $17^{\circ} 19'$ N., longitude $106^{\circ} 46'$ W.; wind N.N.E., and squally appearances; took in light sails; at 2.10 P. M., made sail again to topgallant-sails and mainsail; barometer 29.78; at midnight, wind N.E. by N., and squally appearances; barometer 29.78; to 4 A. M., squally; barometer 29.75; from 4 to 8 A. M., strong gale from N.E. by E.; three reefed topsails, &c.; barometer 29.73; from 8 to noon, strong gale; under storm-sails; gale at 10 A. M., E.N.E.; at 11, E. by N.; at noon, east; barometer 29.74; in latitude $15^{\circ} 20'$ N., longitude $106^{\circ} 15'$ W. From noon of 25th to 4 P. M., gale E.N.E.; weather unchanged; barometer 29.63; from 4 to 8 P. M., gale the same; barometer 29.67; 8 P. M., gale strong from E.N.E., with rain; at 9 P. M., gale N.E. by E.; weather unchanged; at 10 P. M., bore up, and ran S.W. by W. to clear the cyclone; at 11 P. M., gale N.E.; barometer 29.62; [probably then nearest to the storm's centre;] from midnight to 4 A. M. continued to run off the course; gale abating; at 1 A. M. the wind was N.N.E.; at half past 1, N. $\frac{1}{2}$ W.; at 2, N.N.W.; barometer 29.64; at 5 A. M., wind S.W., and fresh; at 8 A. M., barometer 29.75; at noon, (October 26,) observed in latitude $14^{\circ} 32'$ N., longitude $106^{\circ} 43'$ W.

This was a severe cyclone, as I am informed by Lieutenant Bent, although it appears to have been of limited extent, and of slow progress. Had the ship bore up at an earlier period, it is likely that much of its force would have been avoided.

Track 13.—The ship *Sylph*, F. N. Gardiner master, on her passage from Panama for San Francisco, encountered a severe hurricane on the 21st and 22d of June, 1849, in latitude $15^{\circ} 55'$ N., longitude $116^{\circ} 16'$ W. This position is intersected by track 8 on the chart, which thus may represent both storms, as their tracks must have coincided nearly.

In order to bring into one view the storm paths of both the Atlantic and Pacific oceans, I have placed on the eastern border of the chart the tracks of five of the cyclones of the Atlantic basin, which are taken from my storm charts previously published.

RECURVATION OF STORM PATHS IN THE EASTERN PACIFIC.

In the case of the cyclone marked (7,) we find direct evidence of its recurvation on the Mexican coast, near latitude 20° N. It is quite probable that other cyclones of this group had already commenced their recurvation at the time of our latest notices of their progress. Such cyclones as recurvate near latitude 21° N., and near the coast, fall directly upon the Mexican shores of the Californian Gulf. These storms sometimes exhibit great violence at and near the ports of Ipala, San Blas, and Mazatlan.

One of these cyclones, represented as a "terrific gale," occurred so late as June, 1855; and I have seen a number of accounts of similar visitations. On the first of November, 1839, according to Commander Hamilton, of her Majesty's ship *Frolic*, twelve ships were surprised by one of these gales in the port of Mazatlan, and the greater part were lost, and all on board perished. And on the first of November, 1840, three vessels were lost in the road of San Blas, and several people were drowned, without it being possible to render them any assistance.

Most of the cyclones which I have last described, however, must have recurvated in a more advanced position in the Pacific ocean; and in their subsequent northeasterly progress they would fall almost perpendicularly upon the coasts of the two Californias, or the more northern territories. Thus, instead of sweeping a great length of these coasts successively, as happens on our Atlantic border, these cyclones appear more like local storms, and cannot be traced consecutively on the coast line. At the point of intersection with the coast, the first and main portion of the gale will be felt from the southeast, on its centre path, or more southerly, in its right-hand quadrants. And near the coast, the northeasterly or reflex winds of the cyclone, pertaining to its first left-hand quadrant, will not be strongly developed.

We learn from Lieutenant Commander Wood, of her Majesty's ship *Pandora*, that from Cape San Lucas to San Diego, or from latitude 23° to latitude 32° N., the coast is subject to violent gales from S.E. from November to April, and that they are more frequent as we go towards San Diego. Before their recurvation, these cyclones are likely to have passed westward in lower latitudes than those which fall on the Mexican coast.

From San Diego to San Francisco, the coast is subject to southeasterly gales, like those of the coast of Lower California, but they are more frequent here, and blow with greater force. These gales, according to Lieutenant Wood, "last from twelve hours to two days, and are accompanied by heavy rain, which lasts till the wind changes, which it often does very suddenly, and blows as hard for a few hours from the northwest, when the clouds clear off, and fine weather again succeeds." This is a clear description of the phenomena of cyclones, as shown on their center-paths, while moving in a northeasterly course.

The same authority states that, from San Francisco to the Straits of Juan de Fuca, hard gales from all points of the compass may be looked for at all seasons. These begin generally from southeast to southwest, bringing thick rainy weather with them. After blowing from

these quarters for some hours, they fly round to the northward, by the west, with little, if any, warning, and blow even harder than before. These changes show the observer to have been in the right-hand quadrants of the gale, as most often will happen, and are but counterparts of the changes met with in the cyclones encountered in the same latitudes in the North Atlantic.

Having referred to the frequent occurrence, and the normal progression and rotation of the cyclones throughout the temperate latitudes of the North Pacific ocean, as shown chiefly by the single reports of various ships and voyagers, I will now only quote two or three notices of this character which have lately come to hand.

The schooner *Eagle*, from San Francisco for Monterey, encountered a severe gale from south-east in about latitude 37° N., and was compelled to heave to—split the foresail, &c. The wind then shifted to northwest, when she bore up, and reached San Francisco on the 1st of January, 1855. It will be seen that this vessel was on the center-path of the cyclone, as is shown by the direction and change of the wind.

The ship *Dalmatia*, from Cape Ommany for San Francisco, on the 14th of December, 1854, in latitude 55° N., longitude 139° W., encountered a violent hurricane, which commenced at east, veered to south, and lasted forty-eight hours, carrying away main topgallant mast, yards, and sails; lost boat, cut-water, chain-bolts, round house, rail, bulwarks, and sustained other damage. The variation here being between 20° and 30° E., the first severe wind of the gale was about E.S.E., true meridian, indicating a position near the center-path of the cyclone. But her course being south, the ship would soon pass into the right-hand quadrants of the gale, and thus be headed off by the wind as it veered to the southward.

On the first day of January, 1855, off Cape Mendocino, latitude $40^{\circ} 30'$ N., the *Dalmatia* experienced another gale from southeast to northwest, attended with a heavy cross sea.

In reference to one of these cyclones, the master of the *Dalmatia* states that he has never, during an experience of thirty years, encountered so severe a gale.

The schooner *Page*, from Japan for San Francisco, on the 18th of January, 1850, in latitude $45^{\circ} 12'$ N., longitude 180° meridian, encountered a heavy gale from the southwest. On the morning of the 19th the wind changed, and blew a hurricane from the west-southwest. At 6 p. m. scudding under bare poles. On the 20th, at 2 a. m., the *Page* was boarded by a tremendous sea, which struck square aft and swept the decks, carrying with it the cabin gangway and binnacle, galley, and store-room, the pump-brakes, boats, and bulwarks.

Barque *Rebekah*, at San Francisco, April 1, from Batavia, experienced heavy weather during the passage. March 15, (1856,) in latitude 37° N., longitude 160° , experienced a severe gale from the southwest, and shipped a sea which washed away quarter-boat, stove longboat, head knees, and bulwarks. During the last nine days of March had strong southeast gales—split sails, &c.

These imperfect notices of the cyclones which prevail in the North Pacific ocean are respectfully submitted for the consideration of the officers both of the naval service and mercantile marine. If they shall contribute in any degree to the safety and success of our ships and commerce, it will be a grateful reward for the attention and labor which this important subject has at any time required.

I have the honor to be, very respectfully, your obedient servant,

WM. C. REDFIELD.

Commodore M. C. PERRY,

Commander-in-chief of the late U. S. Expedition to Japan.