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NATIVE ASTRONOMY IN THE CENTRAL CAROLINES

WARD H. GOODENOUGH



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by

Ward H. Goodenough

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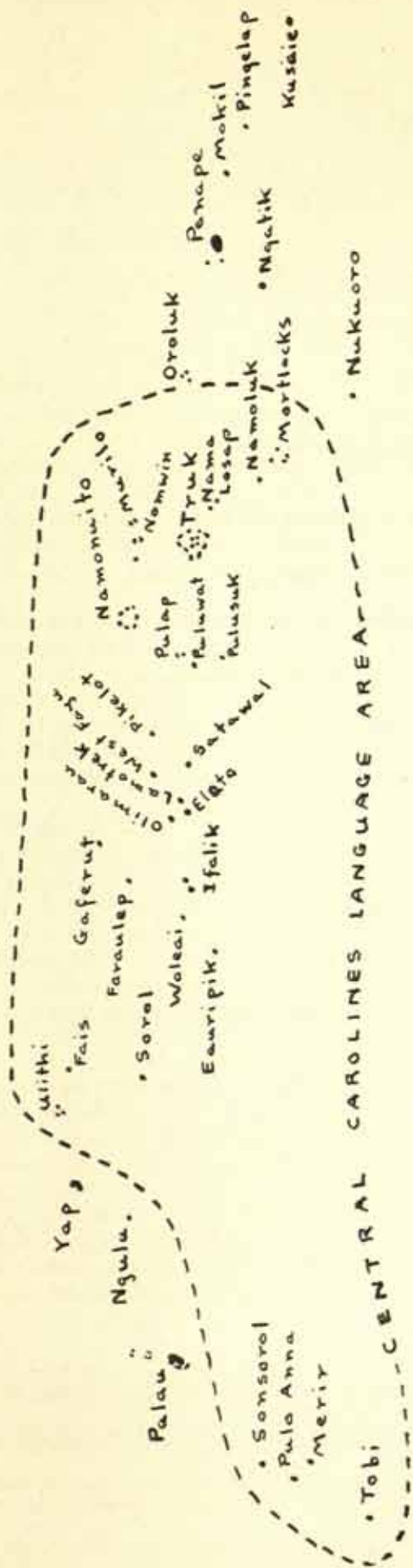
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Guam



Kapingamarangi

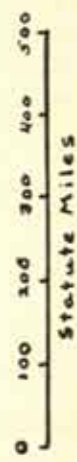
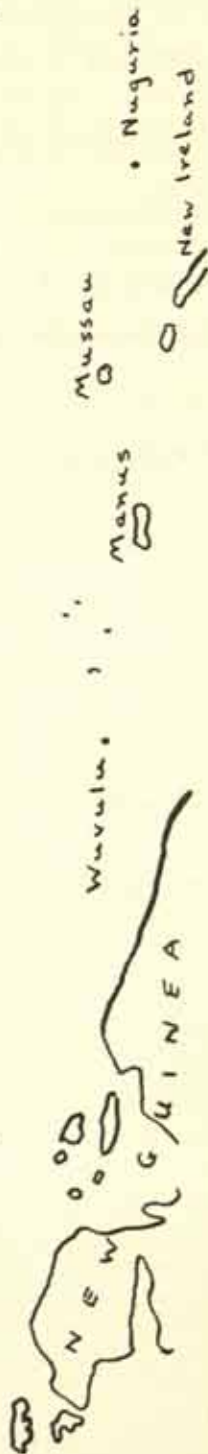


Figure 1. Map of the Caroline Islands.

INTRODUCTION

The natives of Oceania have long been recognized for their outstanding abilities as sailors and navigators. That astronomy played an important role in their navigational art has also been obvious. Its details, however, have remained obscure. The one comprehensive work on Polynesian astronomy so far published shows this clearly (Makemson, 1941).¹ While more has been known of the role of astronomy in navigation in Micronesia, published materials have been sketchy (Sarfert, 1911; and Hambruch, 1912). The writer knows of only one previous attempt—by Grimble (1931) for the Gilbert Islands—to work out the details of a native astronomy and to present it as a coherent and systematic discipline.

Although the writer has participated in a study of the native society of Truk in the Central Carolines,² nearly all of the data on which he has relied for this report have come from published ethnographic sources. The writer was unable to elicit much information on native astronomy from his informants, nor did he pursue the subject with any intensity in the field, where he was primarily concerned with other facets of Trukese culture. It was not until his return, when he undertook to compare the calendar he had obtained with those reported by others, that he became concerned with the problem of native astronomy. It follows that many of the conclusions presented here are tentative.³ They need validation in the field, and that soon, before the lore is forever lost.⁴

Our procedure has been aimed at taking advantage of two major types of evidence. The first is philological. We have tried to set up equivalences from island to island in the form of cognate star names wherever possible. The second type of evidence is provided by the way in which local astronomies appear to be organized. Over a number of islands there are two systems in which the ordering of stars is crucial, a system of spatial coordinates based on the azimuths of stars at rising and setting, and a calendrical system based on the time order of their rising. The degree to which the astronomies of two islands are similar has been determined with respect to (1) the number of star names they have in common, and (2) the positions such common star names occupy in the calendrical and directional systems. Correspondence of the latter sort is of special importance, for native stars are frequently identified erroneously or not identified at all in the sources. The position which a star occupies in either of the two systems provides an excellent check on its probable identity, often revealing what must be construed as ethnographers' or informants' errors. While allowance must be made for local differences, once the nature of a system is clear, its elements must be such as will permit it to work. Since both systems are crucial to native navigation, and since the Carolinian people are eminently successful navigators, it is safe to assume that their directional and calendrical systems are thoroughly workable. Fortunately, the sources leave little doubt as to their nature.

What is known of Micronesian astronomy, when analyzed in this manner, reveals that with but minor local variations essentially the same astronomy is in use throughout the central and western Carolines. Except for Palau, Yap, Ngulu, and the Polynesian atolls of Nukuoro and Kapingamarangi,

¹See Bibliography for full references.

²The writer spent six months on Truk in 1947 under the auspices of the Pacific Science Board of the National Research Council, the Office of Naval Research, the Viking Fund, Inc. (Weener-Gren Foundation for Anthropological Research), and the Department of Anthropology, Yale University.

³A summary of our conclusions has recently been published (Goodenough, 1951a). In this fuller analysis, we present the data on which they are based.

⁴That native astronomy may well be dying out even on such isolated atolls as Ifalik appears from the calendar obtained there by Dr. Edwin C. Burrows, who has kindly made his field notes available for this study (see below, Table 2).

all the islands west of Ponape are closely linked both culturally and linguistically. Together they constitute what we shall call the Central Carolines Language Area (Fig. 1). It is not surprising, therefore, that differences in their local astronomies are not great. Regular intercourse between navigators from the various islands has, no doubt, served to maintain an homogeneity of knowledge. It is no exaggeration to say that there exists in this area a truly international discipline of astronomy and navigation in which most of the local cultures share.¹ It has spread to a few peoples with different linguistic affiliations. The natives of Yap and Ngulu have borrowed the navigational methods of their neighbors on Ulithi and with them the appropriate astronomy.² The calendrical system on Polynesian Nukuoro has clearly been borrowed from neighboring central Carolinian atolls. Beyond this, however, while cognate names for stars appear as far east as the Marshall and Gilbert Islands and as far south as Ontong Java in Melanesia, it is clear that we are dealing with astronomies which differ considerably in both nomenclature and organization.³ There are enough similarities, however, so that data from these islands can sometimes help resolve problems of constellation identification presented by the central Carolinian sources. For this purpose the careful identifications by Erdland (1914) in the Marshalls are of special value.

As should already be apparent from these introductory remarks, one of the major concerns of this study is the identification of native stars and constellations. While at first glance this may appear to be only of academic interest, we cannot evaluate native astronomy as a navigational tool without knowing what the stars used are, and seeing how their temporal and spatial relations to one another as determined by western astronomical science compare with native ideas on the subject. Full presentation of the linguistic evidence is also essential for any realistic discussion of the origins of Carolinian astronomy. If this account seems overly attentive to these matters, it is only because our conclusions stem from their consideration.

¹*Cf.* Christian (1899: 395), who reached the same conclusion on scantier evidence.

²Müller (1917: 286). For the close relations between Yap and Ulithi, see Lessa (1950a).

³See, for example, the Ponapean star list given by Christian (1899: 388).

NATIVE ORIENTATION

In the ancient world, astronomy owed its development to the requirements of agriculture and became the specialty of priests in agricultural cults. In Micronesia, astronomy owes its development to the requirements of navigation. Knowledge of the stars, their names and movements, is very largely restricted to professional navigators.¹ As private, incorporeal property—a trade secret—it is bequeathed in the Central Carolines from father to son, and among these matrilineal peoples, from mother's brother to sister's son. Anyone unable to acquire such knowledge in this way must purchase it from its owners.² Where the art of navigation has been lost, astronomy, as one of its adjuncts, has also disappeared.³ Native astronomy, therefore, has aimed at meeting the practical problems of sailors, whose lives depended on it. Its form as a primitive science is a direct result of this orientation.

Knowing where he is and what to expect in the way of weather are two major concerns of a deep water sailor. It is these concerns which underlie the development of Carolinian astronomy. Only in relation thereto has there been any systematization of heavenly phenomena, and this on a strictly empirical basis. From the movements of certain stars navigators have developed a sidereal compass in terms of which they give all sailing directions. They have also developed an almanac and calendar which they use to predict seasonal winds, currents, rains, and overcasts.

Given this approach, it is not surprising that stars and constellations appear to be named only in so far as practical considerations require. Those with specific names do not seem to exceed thirty or forty in number. Position, rather than magnitude alone, is important in determining which stars are named and which not, a feature of native astronomy also noted for the Marshall Islands by Erland (1914: 78): "It is surprising that many stars of first magnitude, such as Sirius and Rigel, have no name, whereas many of the constellations given names by the native navigators are composed of stars of from fourth to fifth magnitude."⁴ While some constellations are of immense size, most are small, consisting of three or four closely clustered stars.

The long axis of the Caroline chain is oriented east and west. Its islands and atolls are strung out for fifteen hundred miles between the fifth and tenth parallels of north latitude. This location has made it practical for native navigators to assume that the east-west axis of their islands forms the terrestrial equator and corresponds with the celestial equator. With visibility uninterrupted in all directions, they make their observations with reference to the great circle of the horizon. The points at which stars rise and set (their azimuths) and the time order of their rising (their relative altitudes) provide the respective bases for the native compass and calendar. At this latitude differences in azimuth and altitude correspond very closely with differences in declination and right ascension (celestial latitude and longitude). This close to the equator, the path of a star which rises due east from an observer will come very close

¹Cf. Grimble (1931:197), who says of the Gilbertese: "If you would find an expert on stars, you must ask for a *tiaborau* or navigator. This fact affords a correct measure of the significance of astronomy to the native; he regards it as a mere adjunct (though an important one) to the larger science of navigation." Erland (1914: 76-78) reports a similar situation in the Marshalls.

²See our discussion of incorporeal property on Truk (Goodenough, 1951b) and the remarks of Damm and Sarfert (1935: 83) for Puluwat. Compare with Grimble (1931), Erland (1914), and Makemson (1941: 272) for other parts of Oceania.

³It is reported, for example, that on Sorol (Damm, 1938: 250) the population was nearly wiped out in the middle of the last century, with the result that navigational and astronomical knowledge was lost.

⁴This fact has undoubtedly contributed to errors of identification in existing sources and requires that field work be done with the aid of a detailed star atlas. One should scarcely have to add that such work should be done at night, except that it seems clear from the nature of some of the reported errors that identifications were all too often based on verbal descriptions. Only thus can I account for a common identification of a native constellation in Cassiopeia with Orion.

to going through the zenith over the observer's head. Native astronomers do not, therefore, distinguish azimuth and altitude from declination and right ascension, but deal with the former as though they were the latter. They divide the heavens into a series of latitudinal bands called *jaan*, "paths." All stars which rise and set at the same place follow the same *jaan*.¹

Despite the long history of careful observations which can be assumed to underly the sidereal compass and calendar, it is interesting that no cosmogony or astronomical theory has been developed. The writer could obtain no popular theories as to the nature of the stars on Truk. They and their movements were simply accepted as given facts of nature by all informants. The natives of Ifalik are similarly reported by Damm (1938: 46) to be without any explanation for the sun or stars. This observation has since been confirmed by Burrows (1947: 8). While among specialists there may have been a mythology of the stars, it has not been recorded. In view of the apparent absence of a developed cosmogony, it is likely that such mythology, if there is any, serves mnemonic rather than philosophical purposes. Micronesian star-myths from other islands support this conclusion, as do other facets of Central Carolinian mythology.²

Considering the intense native interest in divination and luck,³ it is equally noteworthy that the Central Carolines has produced no astrological systems of the sort reported for parts of Polynesia (Nakemson, 1941: 116-152). There is, of course, plenty of magic and divination connected with ocean voyaging, as Lessa (1950b: 130, 141-3) recounts for Ulithi, but in it the stars apparently play no part.⁴ Linked as it is with direction-finding in navigation, native astronomy is perhaps too important for personal safety to permit its being removed from an empirical context.

As the foregoing considerations suggest, Carolinian astronomers are mainly interested in the fixed stars. There is only minor concern with the sun, *jakkar*, "scorcher", or *jöön*,⁵ and this in connection with the calendar. The phases of the moon, *maram*, provide the basis for a thirty-day lunar month, but otherwise evoke little interest. Planets are simply unpredictable stars and therefore of no use in navigation or time reckoning. Only Venus is named, with one name as Morning Star and a completely different one as Evening Star. Meteors, finally, are not classed as heavenly bodies at all, but are *soope*, "ghosts."⁶ It is with the stars, *fy*, that native astronomers are concerned.

¹Cf. The Gilbertese organization of the heavens as described by Grimble (1931).

²While no star myths are recorded from the Central Carolines Language Area, see Erdland (1914: 82-9) for the Marshalls and Hambruch (1936: 156-9) for Ponape. Damm and Sarfert (1935: 86) assert that there is a rich mythology of the stars among navigators on Puluwat but offer no examples. For an excellent example of the mnemonic myth in the Carolines see Girschner's brief discussion (1912: 199-200) of the mythology of knot divination on Namoluk. The purpose of this mythology is to help the practitioner remember the names and meanings of the many combinations of knots used for divining by building them into the plot of a story. Grimble (1924: 134) also explains Gilbertese navigation myths as mnemonic: "One of the methods of memorising the guiding stars on any specific course was to weave a tale about them, wherein they figured as persons or objects seen during the voyage of some fictitious character."

³See, for example, the accounts by Bollig (1927: 65-8) and Girschner (1912: 199-208).

⁴See also the role of magic in Gilbertese navigation (Grimble, 1924: 128-131).

⁵All native terms are given in Trukese except where otherwise indicated. Words preceded by an asterisk (*) have not been recorded by the writer in Trukese, but represent his reconstruction of the form they presumably have in that dialect. The orthography for Trukese is that of Dyen (1949), except that "pw" is used for his "q" and "mw" for his "b." The orthographies for other Central Carolinian dialects are as given in the sources with minor modifications to enable use of standard fonts. The nature of these modifications is readily apparent from comparison with the original sources. The latter are by no means consistent in their orthographies nor do they explain them.

⁶Popular saying has it that meteors are the souls of men which in their flight through the sky must pass under a great inverted bowl whose rim is lined with sharp teeth. The bowl is constantly being raised and lowered. Shooting stars are souls scooting under when it is raised so as to reach the other side before it falls again. A moaning sound heard in connection with a meteor means that the soul is crushed by the bowl's teeth and that its owner will die.

THE SIDEREAL COMPASS

As seen in the Carolines, the great "path" which passes from east to west through the zenith is that taken by Altair (α Aquilae, declination 8.5° north), which is, therefore, the base star in the native compass. Its point of rising marks due east, *jēētiw*, and its point of setting due west, *notow*. The arc through the zenith connecting these two points forms the celestial equator dividing north from south. The North Star is just visible above the horizon and indicates due north, *jefeg*, while due south, *jēēr*, is the point at which the Southern Cross (Crux) is seen when in its upright position above the southern horizon. The arc through the zenith between these two points forms the native meridian and divides east from west.¹

Between these four cardinal points of the Carolinian compass are twenty-eight additional points marked by the rising and setting of other stars following different paths parallel to that of Altair. East is the first compass point, and the remaining positions are usually listed from Altair north and then from Altair south, first in the east and then in the west. It will be more convenient for us to follow our own conventions in this regard and start with north. From north to south, then, the points of the compass are marked by Alpha Ursae minoris (North Star) followed by the points of rising of Beta Ursae minoris, Alpha Ursae majoris, Alpha Cassiopeiae, Alpha Lyrae (Vega), Pleiades, Alpha Tauri (Aldebaran), Gamma Aquilae, Alpha Aquilae (Altair), Beta Aquilae, Orion's Belt (δ, ϵ, ζ , Orionis), Corvus, Alpha Scorpii (Antares), Kappa or Lambda Scorpii (in Scorpio's tail), and Crux. The next point is marked by the position of Crux at the rising of Alpha Centauri (when Crux has an altitude of roughly 45° east), and the final southern position is that of Crux upright. The first position starting up from the south in the west is marked by the position of Crux when Alpha Centauri is at or just past the meridian (when Crux has an altitude of roughly 45° west). The remaining positions in the west are marked by the points of setting of the same stars and constellations as are used in the east. The name of each point is provided by its star. The resulting compass is illustrated in Figure 2.

The use of this compass does not depend on the visibility or immediate position of the stars for which the compass points are named. Other stars with the same "path" serve as indicators. The point of Vega's rising, for example, is fixed regardless of where Vega is. It is simply the type-star for which the direction is named. The compass, therefore, is a complete abstraction consisting of theoretically fixed points which furnish a set of spatial coordinates. While a compass of this kind will change radically in different latitudes, the east-west orientation of the Carolines is such that the system remains in fact fairly fixed for the whole archipelago. Markedly different latitudes can presumably be determined by observing which star-path passes through the zenith.

Native representation of this compass sometimes takes the form of a square, more often of a circle representing the horizon. The finer gradations of the compass in the east and west reflect the geographical orientation of the Caroline Islands. Finer gradations in the north and south reported for Sonsorol, Pulo Ana, and Merir (Eilers, 1935-6) — accomplished by adding extra positions to the standard compass — similarly reflect the location of these islands in relation to Palau, Yap, and Ulithi.

All sailing directions are given in terms of this compass. To go from island A to island B, for example, one sails from the rising of X to the setting of Y. The prevailing wind of a particular season comes from the direction of the rising of Z, so that a navigator can orient himself in the daytime on the basis of wind directions and, with a like set of correlations, on the basis of prevailing currents.

¹The best account of this feature of native astronomy is given by Kubary (1880: 288); cf. the excellent account for the Gilberts by Grimble (1931).

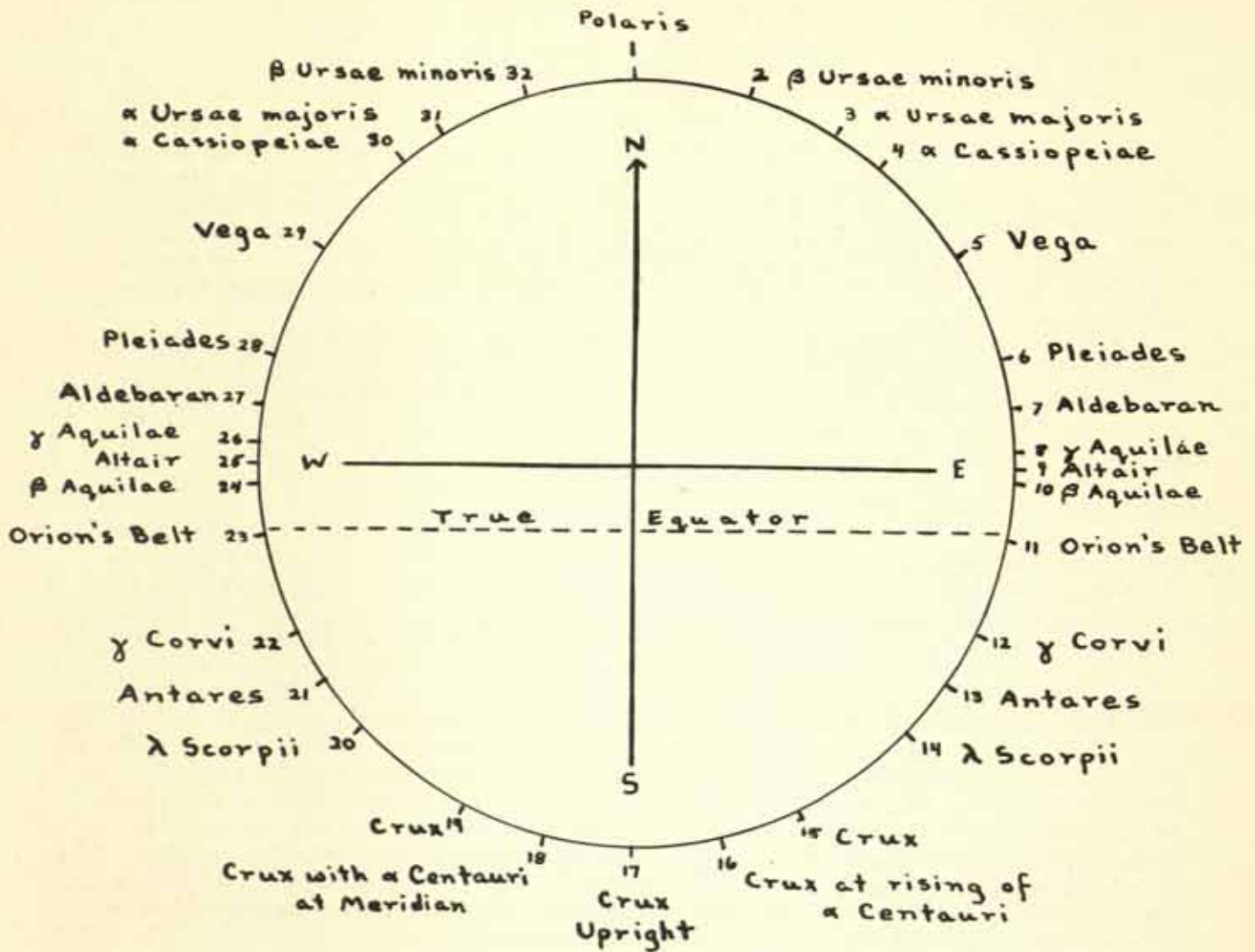


Figure 2. The Sidereal Compass of the Central Carolines

As will be clear in our review of the evidence, the star-compass is standard throughout the Central Carolines Language Area and is also in use on Yap and Ngulu. This is eloquent testimony to the large volume of traffic between islands in this wide area. Although navigators jealously guard astronomical knowledge as a part of their professional secrets, there is obviously a free exchange of information among accepted members of the profession. Some of the taboos surrounding them may serve to facilitate this exchange. Navigators are not supposed to eat any food that is not separately prepared for them.¹ Abroad as well as at home, therefore, they dine apart at the local "navigator's mess," where we may assume that conversation inevitably turns to the circumstances of the latest voyage, the course followed, and weather conditions encountered.

In line with this exchange, it is customary for navigators to note on the star compass the relative location of all new lands encountered and to add this information to existing knowledge. As a result, Damm and Sarfert (1935) obtained from a navigator on Puluwat a list covering several pages of fine print giving sailing directions in terms of his compass from every known place to every other known place. He gives each course both directly and with respect to a third island or reef to provide another point of reference and an alternate landfall. Lands lying along a given axis of the compass are also known. This, coupled with the number of days sailing by which they are known to be separated, has made it possible for navigators to astound western observers with the accuracy with which they can make sketch maps of the Caroline chain. In the absence of writing, of course, all of this information must be memorized. It is small wonder that professional navigators stand at the peak of the prestige ladder in Central Carolinian society.

It remains now to present the evidence for the conclusions outlined above. We shall discuss each compass position in turn and give the evidence for each in two parts: A, the names for the position as recorded from the compasses of different islands together with ethnographer's identifications and translations, and B, cognate forms of the star name reported in contexts other than that of the compass, which has not been recorded for some islands. Under both A and B the data are listed in order of island and source. Islands are represented by numbers, and the several sources, if there are more than one, by letters, as follows:

| <u>Number</u> | <u>Island</u> | <u>Source</u> |
|---------------|---------------|---|
| 1. | Truk | a. Goodenough (field notes) b. Elbert (1947: 288-9, 219) c. Krämer (1932: 302-3) d. Bollig (1927: 207) |
| 2. | Mortlocks | Kubary (1880: 288-9), <i>cf.</i> Christian (1889: 389, 393) |
| 3. | Namoluk | Girschner (1912: 177-8) |
| 4. | Nama-Losap | Sarfert (Krämer, 1935: 152) |
| 5. | Murilo | Krämer (1935: 187) |
| 6. | Nomwin | Elbert (1947: 319) |
| 7. | Namonuito | Krämer (1935: 232) |
| 8. | Pulap | Krämer (1937: 129-31) |
| 9. | Puluwat | Sarfert (Damm and Sarfert, 1935: 88-90, 273) |
| 10. | Satawal | a. Sarfert (Damm and Sarfert, 1935: 88-90, 273) b. Freycinet (Damm and Sarfert, 1935: 88) |
| 11. | Lamotrek | a. Krämer and Hambruch (Krämer, 1937: 133-7) b. Christian (1899: 388-9) |
| 12. | Elato | Hambruch (Krämer, 1937: 137) |
| 13. | Ifalik | a. Sarfert (Damm, 1938: 46-7, 98) b. Burrows (1947-8) |
| 14. | Faraulep | Damm (1938: 172-3, 211) |
| 15. | Woleai | Krämer (1937: 272-3) |
| 16. | Eauripik | Sarfert (Damm, 1938: 131, 144) |
| 17. | Sorol | Damm (1938: 250) |
| 18. | Fais | Krämer (1937: 370-1) |

¹When two boatloads of Puluwatese visited the writer and his colleagues on Truk, for example, our houseboys impressed upon us the necessity for cooking and serving the navigators' food separately from that of their crews.

| Number | Island | Source |
|--------|-----------|--|
| 19. | Ulithi | a. Damm (1938: 324-5) b. Müller (1917: 283). |
| 20. | Yap | a. Müller (1917: 286-8) b. Christian (1899: 390-1) |
| 21. | Ngulu | a. Eilers (1935-6, ii: 229-30, 240) b. Müller (1917: 283, 286-8) c. Hambruch (Eilers, 1935-6, ii: 240) |
| 22. | Sonsorol | Eilers (1935-6, i: 83-6, 89) |
| 23. | Pulo Anna | Eilers (1935-6, i: 238-9) |
| 24. | Merir | Eilers (1935-6, i: 360-5) |
| 25. | Tobi | Eilers (1935-6, ii: 110) |

Position 1. (See Fig. 2). This position is known by two names, one the name of the North Star, *fyy se mēkyt* (star not moving),¹ the other by the name for the compass position which it marks, *wenewen efeg* (due north).² The distributional evidence is as follows:

A. 1c. fusamokit (Polaris), 2. fuusamakit (Polaris), 3. fuusa mokit (Polaris), 8. fuumaket, 9. fii he magid (Polaris), 10a. fii si magid (Polaris), 11a. volevol iefang, 13a. wolewole, 13b. wólwól li ievang, 14. oluuol el ijefang (Polaris), 16. wolewole, 18. fisimagut, 19a. ulu'ul jefang, 20a. wonowon ni mailap (Polaris), 21a. onoon (Polaris), 21b. wonowon ni mailap (Polaris), 22. werääweri (Polaris), 23. werawer (Polaris, but the name tawoneng is preferred), 24. worewoi.

B. 1a. fyy se mēkyt (Polaris), 1b. fū se mōkūt (Polaris), 1d. fu e se mokud (Polaris), 10b. oule-houal (Polaris), 11b. uiluil-al-evang (Polaris), 12. uiluil, fiθei magit (Polaris), 15. vol-evol, fissimogedigit (Polaris).

Positions 2 and 32. The rising and setting of Beta Ursae minoris, main star in the constellation *määnapen efeg* (*määnap* of the north).

A. 1c. meilap en efang, 2. meeylap en effeng, 3. meilap en efang (α , β Ursae majoris and λ Draconis), 8. mailupelefang (β Ursae minoris), 9. mailöb bäliefang, 10a. mailöb bäräfäng, 11a. mailap ale fang (β Ursae minoris), 13a. mailöb balewäng, 13b. mailap e li vang, 14. mailop baliefang, 16. mailöb bäräwäng, 18. mailapel efang, 19a. mailop, 20a. mailap lafang (Ursa minor), 20b. mai-le-palafal, 21a. mailop palefang (Ursa minor), 21b. mailap lafang (Ursa minor), 22. maiteperawäng, 23. mariparaweng, 24. meiteberäseng.

B. 1a. määnapen efeg (Dipper ?), 1b. mainapan efeng (Little Dipper without handle), 10b. mainap (Ursa minor), 12. mailap e ie fang (β Ursae minoris), 15. mailop-lēlafang.

Except for the careful identification on Namoluk (3), there is no question but that this constellation involves Ursa minor. It is probably composed of Beta, Gamma, and 5 thereof, with Beta the specific star whose rising and setting marks this compass point. Our conclusion is based on the resemblance these three stars have to the constellation *määnap* of similar name (see positions 8, 9 and 10) and on the existence of just such a native constellation, though otherwise named, in the Marshalls.³ The meaning of *määnapen efeg* is unclear, depending on the derivation of its first element, *mää-*, which in our discussion of positions 8, 9, and 10 below we interpret as possibly meaning "cluster." If this is correct, then *määnapen efeg* means "main cluster of the north."

The sidereal compasses reported for Sonsorol (22), Pulo Anna (23), and Merir (24) have two additional positions between this and the first one, in all probability indicated by Delta

¹The translations by Christian (1899: 389-90) for the Mortlocks as "the seven mice" or "the star that moves or changes its position" are both incorrect.

²The position is sometimes referred to simply as *wenewen*. This word is the doubled form of the root *wene-*, which appears in such compounds as *weneccar* (straight), and has the connotation of "straight," "direct," "due," "on a line," "exactly at." The expression *wenewen efeg*, therefore, is literally the "northern *wenewen*."

³Erdland (1914: 78) reports the constellation *jemenuwe* as Beta, Gamma, and 5 Ursae minoris.

and Epsilon Ursae minoris.¹ These extra compass positions are reported for no other island.

Positions 3 and 31. The rising and setting of Alpha Ursae majoris, *wēna. The distributional evidence is as follows:

A. 1c. uona, 2 oola (Ursa major), 3. oala (γ, ε, ζ, θ, ξ Bootis), 8. nothing recorded for this position, 9. wole, 10a. olāgo, 11a. voelēgo (Ursa major), 13a. olāāgo, 13b. wileugo, 14. uolāgor, 16. wolago, 18. uelōgo, 19a. ologor, 20a. uuelōgo (Ursa major), 20b. ulagok, 21a. mailop pali olox (Ursa major), 21b. uuelōgo (Ursa major), 22. woroox, 23. woraaxe, 24. woraax.

B. 1b. wōna (Ursa major), 10b. oulega (Ursa major), 11b. ualego (Ursa major, "the broom"), 15. volēgo.

Except for Namoluk (3), all identifications agree that *wēna is to be found in Ursa major. Its identification on Namoluk with Bootes gives it a declination lower than that of the constellation in position 4 on the compass. It is not surprising, therefore, that navigators there are said to be uncertain as to which constellation is properly in position 4 and which in position 3 (Girschner, 1912: 178). Just what part of Ursa major makes up *wēna is not clear. Alpha would appear to be the most suitable star for navigation purposes when we consider its declination in relation to that of Cassiopeia, which is identified with position 4. Indirect support of this inference is provided by the Marshallese constellation *wādal kan*, consisting of Alpha and Beta Ursae majoris (Erdland, 1914: 79).

Positions 4 and 30. The rising and setting of Alpha Cassiopeiae in the constellation *wykyn iik*, Cassiopeia, meaning "tail of the fish."

A. 1c. ukenik (Orion), 2. uken ik, 3. uuk en iik (γ, δ, ε, ζ, η Ursae majoris, "fish net"), 8. ugulik (Cassiopeia), 9. ugeniik (Orion), 10a. ugeliik, 11a. ūgulūg (Cassiopeia), 13a. uge-liik, (Orion, but on star map is given in position of Cassiopeia), 13b. ugiliik, 14. ugeliga, 16. ugeliik (Orion), 18. egelik, 19a. igillūk, 20a. uugenig (Cassiopeia, "fish-tail"), 20b. yigelik, 21a. ugenix (Cassiopeia) 21b. uugenig (Cassiopeia), 22. igriāg, 23. grieg, 24. grieg.

B. 1a. wykyn iik ("fish-tail"), 6. ūkūn ik ("fish-tail"), 11b. yuk-ul-ik (Cassiopeia, "fish-tail"), 12. jugelik (Cassiopeia, "whale's tail"), 15. ugelik, gugeliik.

With the exception of Namoluk (3), this constellation is identified with Orion or Cassiopeia. Orion's declination rules it out as a possibility, whereas Cassiopeia fits the position which this constellation occupies in all the sidereal compasses reported. The frequent identification with Orion, however, requires explanation. A number of these identifications are given by one ethnographer who covered several atolls. A single error may thus have been extended by analogy to similar star names obtained elsewhere. A source of confusion is also to be seen in the two translations of the native names as "fish-net" (Trukese: *wuken iik*) and "fish-tail" (Trukese: *wykyn iik*). Wherever the name is spelled with a high stem-vowel in its first word element or is translated as "fish-tail," the identification is with Cassiopeia. Because of this, and because of its position on the sidereal compass, there is little question that this constellation is properly identified with Cassiopeia and named *wykyn iik*. Corroborative evidence is furnished by the Marshallese constellation *lok in lageege*, "tail of the porpoise," consisting of the five major stars of Cassiopeia (Erdland, 1914: 80). The Marshallese also recognize a constellation *uk an aarik*, "fish-net of the new moon," composed of Beta, Nu, Mu Bootis and Mu Coronae borealis (Erdland, 1914: 79). This suggests that ethnographers and possibly even informants have confused two constellations, "fish-net" and "fish-tail." On Namoluk it is clear that Girschner's informants interpreted the name for this compass position as "fish-net" and associated it with the handle of the Big Dipper, which has almost the same declination as Cassiopeia. The resulting possibility for confusion with position 3 may have led to the reidentification of *wēna with Bootes on Namoluk and the feeling that positions 3 and 4 were twisted, as we have already noted in connection with position 3 above.

¹These positions are: 22. *ifangefang* *ṭaupite* and *ifangefang*, 23. *ṭanggeṭang* *ṭaupite* and *ṭanggeṭang*, 24. *riwaggavang* for both.

Of interest are the forms of the name *wykyn iik* reported for the islands of Sonsorol (22), Pulo Anna (23), and Merir (24). That the names are related to the Trukese form is clear from the correspondence of Trukese "n" with "r" of the southwestern dialects as well as from the common position the names occupy in the sidereal compasses. The form of these names, however, with loss of initial and stem vowels in the first word element would make it appear that they have been heavily corrupted, either because the original meaning was forgotten or because the names were borrowed sometime in the past (prior to the r/n sound shift) and garbled in the process.

Positions 5 and 29. The rising and setting of Vega Lyrae in the constellation *mēēn*.

A. 1c. man, 2. moel ($\alpha, \beta, \gamma, \delta, \epsilon$ Lyrae), 3. moal (Lyra), 8. mōl (Vega), 9. mōōl (Lyra), 10a. mōl (unidentified, but the constellation mailik is said to be Lyra), 11a. maal, mēl (Vega), 13a. mōōl (Lyra), 13b. meel, 14. mal (Procyon), 16. maal (Procyon), 18. mōn, mōl, 19a. moom, mol, 20a. mol (Lyra with Vega), 20b. moul, 21a. moon (Vega), 21b. mol (Lyra with Vega), 22. mauri, 23. maur, 24. mauri.

B. 1a. mēēn, 1b. mōn (Orion), 4. mol, 5. mēēl, 7. mōl, 10b. meul (Lyra), 11b. meal (Vega), 12. mol (Vega), 15. mōl, 17. mool (Canis major).

Some identifications and spellings show that ethnographers have confused this with another constellation. In Trukese the two are *mēēn* and *maan* (combining form *-mēn*). Here we are dealing with the former, which is clearly in Lyra, with Vega the important star for navigational purposes. The constellation *maan* ("bird"), on the other hand, is an enormous one, including both Procyon and Canis major and with a declination which in no way fits position 5 on the sidereal compass. Both *maan* and *mēēn* are employed in the native calendar, where similar confusions appear. Their respective right ascensions, however, lead to the same conclusions there as are indicated by their declinations here.

Elbert (1947: 121) derives the name *mēēn* from a form he gives as *imwen*, "adze-handle." He is probably reporting a popular etymology by his Trukese informant, who, moreover, is the only one who identifies this constellation with Orion.¹ The meaning of the name remains, therefore, obscure, unless a clue is provided by a Trukese homonym meaning "squirrel fish" (Elbert, 1947: 120).

Positions 6 and 28. The rising and setting of the Pleiades, *mweriker*. The distributional evidence is as follows:

A. 1c. moeriger (Pleiades), 2. meeriker (Pleiades), 3. mweriker (Pleiades), 8. moeriger (Pleiades), 9. mariger (Pleiades), 10a. mariger (Pleiades), 11a. magariiger (Pleiades), 13a. mariger (Pleiades), 13b. magariigari, 14. maraegiri (Pleiades), 16. magariir (Pleiades), 18. magereger, 20a. magiregir (Pleiades), 20b. magiregir, 21a. mar geregir (Pleiades), 21b. magariiger (Pleiades), 22. marailigeegl, 23. marailigel, 24. marailigeel.

B. 1a. mweriker (Pleiades), 1b. mweriker (Pleiades), 1d. mōrgōr (Pleiades), 4. maarigu, 5. maragar, 11b. magariigar (Pleiades), 12. margaregir (Pleiades), 15. magareger (Pleiades), 17. maaleg (Pleiades).

This is one of the most important of the native constellations. It provides the name for one of the sidereal months as well as for this compass position, and is one of the few constellations which everybody knows and which plays a role in popular legends. Its heliacal rising coincides with the beginning of the rainy season and of the major breadfruit harvest on Truk, which may be a reason for its popularity.

The name *mweriker* has been wrongly interpreted as a cognate of the Polynesian name for the Pleiades, *matariki* (Makemson, 1941: 5, 232).² While it is possible that there are

¹Trukese legends reveal that popular etymologies are a common native device for explaining things.

²If the interpretation of the Polynesian name as "little-eyes" is correct, then the cognate form in Trukese would be *mesecik (cf. the Marshallese constellations *mejetrikrik* and *lemejetrikrik* reported by Erdland, 1914: 79). The form *mweriker* appears to be derived from an earlier *moxerixeri < *mexarixari (cf. *megarigari* in the Ifalik dialect). There is evidence to suggest that in the eastern dialects of the Central Carolines Language Area a former velar spirant "x" (or possibly a palatalized velar stop) has been lost, except when preceded by a high vowel where it has been assimilated to "k". Compare, for example, the Tobian words for "thirty," "forty," "fifty," "sixty,"

some star names common to both Polynesia and the central Carolines, this is not one of them. There is no Polynesian star name in the long list compiled by Makemson (1941: 198-271) which is cognate with *mweriker*. Nor is the latter name ubiquitous in Micronesia, the Pleiades being called *jābro* or *jeleeileng* in the Marshalls (Erdland, 1914: 80) and on Kusaie (Sarfert, 1919: 223) and *nei auti* in the Gilberts (Grimble, 1931). In Melanesia still different names appear, e.g., *tjasa* among the Manus (Parkinson, 1907: 377), and *apurunge*, "tangle," on Ulawa and Sa'a (Ivens, 1927: 396).

The meaning of *mweriker* remains obscure. Elbert (1947: 127) reports it as "rough coconut-leaf basket" in Trukese. In view of the fact that another constellation is named *sepi*, "wooden bowl," his translation is compatible with native usage in naming constellations. Girschner (1912: 178), on the other hand, gives "Seefisch" as the meaning on Namoluk, which equally accords with native usage. The problem presented here has probably resulted from the inevitable tendency for names of this sort to lose earlier meanings and pick up new ones, particularly after a language has changed so as to obscure their etymological derivation.

Positions 7 and 27. The rising and setting of Aldebaran (α Tauri), called *wuun*. As a constellation, *wuun* may also include the Hyades.

A. 1c. un, 2. uun (Aldebaran), 3. uun (Aldebaran), 8. un (Aldebaran), 9. uun (Aldebaran), 10a. uul (Aldebaran), 11a. ul (Aldebaran), 13a. wul (Aldebaran), 13b. uulu, 14. oul (Aldebaran), 16. uul (Aldebaran), 18. uun, uul, 19a. uul, 20a. wun (Aldebaran), 20b. un, 21a. un (Aldebaran), 21b. wun (Aldebaran), 22. uur, 23. uur, 24. uuru.

B. 1a. wuun, 1b. un ("maggot"), 1d. un, 4. un, 5. uun, 7. uoun, 10b. oul (Aldebaran), 11b. ul (Aldebaran, "the virile member"), 12. uul (Aldebaran), 15. vul, 19b. wul, 25. uur.

There is no question as to the identification of this star. On Yap (20a) the constellation is said to include the Hyades. The same name for Aldebaran is reported in neighboring Polynesian atolls as *uun* on Kapingamarangi (Eilers, 1934: 143), and as *una* and *unga* on Nukumanu and Ontong Java respectively (Sarfert and Damm, 1929: 188). A different name is reported for Aldebaran in the Gilbert Islands, but *uun* occurs as the name of an unidentified star (Grimble, 1924: 136).

The meaning of the name is obscure. Elbert's informant interprets it as "maggot" for Truk (1b), but elsewhere Elbert (1947: 219) indicates that the Trukese word for maggot is *ul* in Mortlockese. The star-name, on the other hand, retains its "n" in the latter dialect. Christian's interpretation for Lamotrek (11b) as "the virile member" accords with the Trukese word *wuun*, "testicle," which Elbert (1947: 219) indicates keeps the "n" in Mortlockese. Whether this is the original meaning or another popular etymology, however, cannot be determined from existing evidence.

Positions 8, 9, 10 and 26, 25, 24. The rising and setting of Gamma, Alpha (Altair), and Beta Aquilae respectively. These three stars form the native constellation *māānap*, of which Altair is the main star. Position 9 is named *māānap*, while positions 8 and 10 are called *pēwyn māānap me jefeg* and *pēwyn māānap me jēēr*, "arm of *māānap* in the north" and "arm of *māānap* in the south." The latter positions are often omitted from the compass as locally reported. The distributional evidence for position 9 is as follows:

A. 1c. meilap (Aquila), 2. meeylap (α, β, γ Aquilae), 3. meilap (Aquila), 8. mailap (Altair), 9. mailōb (Aquila), 10a. mailōb (Aquila), 11a. mailap (Altair), 13a. mailōb (Aquila), 13b. mailap, 14. mailop (Aquila), 16. mailōp (Aquila), 18. mailap, 19a. mailap, 20a. mailap (in Aquila), 20b. mailap, 21a. mailop (Altair), 21b. mailap (in Aquila), 22. maθitōp, 23. maθitōp, 24. māθitōp.

"seventy," "eighty," and "ninety" (as we have interpreted orthographies of various authorities as compiled by Eilers, 1935-6, ii: 126-7) with the corresponding Trukese forms: Tobian *θeriix*, *faaiix*, *limeex*, *woreex*, *fθiix*, *wariix*, *tuweex*, and Trukese *jiniik*, *fājiik*, *nime*, *wone*, *fiik*, *waniik*, *tiwe*. Compare also the following Trukese pairs: *jacaw* (cliff) and the place name *Fāāni-kacaw* (under the cliff); the sib name *Jacaw* and the name of the legendary chief of its home island *Sowu-kacaw* (the home island is now called *Kacaw* by analogy from the latter name); *jowupw* (breast) and the mythical being *Ni-kowupw-upw* (the nourisher). We would explain Trukese *sowu-jōtoomej* (breadfruit summoner) instead of **sowu-kōtoomej* as being a recent construction made after the loss of initial "x". For the vowel shifts from **mexarixari* to **moxerixeri*, see Dyen (1949: 433-4).

B. 1a. määnap, 1b. meinap, 1d. mälap, 4. mai lob, 5. mailap, 7. meilöp, 10b. moulap (Aquila), 11b. mai-lap (Altair), 12. mai i löp (Altair), 15. mailap, 17. mailob (Altair), 19b. mailap, 25. masirap.

The distributional evidence for positions 8 and 10 is as follows:

A. 1c. baun meilap efang, baun meilap mē eor, 2. pooun maan me effeng, pooun maan me yer,¹ 9. paun maan me efang, paun maan me yer,¹ 10a. baiifang, baijoor, 13b. pauievang, pauiauru, 20a. pol ii mailap maiefang, pol ii mailap meyor.

Our identification of positions 8 and 10 with the rising and setting of Gamma and Beta Aquilae respectively is based on Kubary's identification of *määnap* for the Mortlocks (2) and Erdland's (1914: 79) report of the cognate Marshallese constellation, *mejlep*, as composed of the same three stars. That positions 8 and 10 are, therefore, very close to position 9 on the compass need cause us no concern, for this accounts for the frequency with which they are omitted from local compasses. It is also reflected in the native diagram of the compass given by Damm and Sarfert (1935: 88-90) for Puluwat and Satawal.

The constellation *määnap* appears in native astronomy throughout Micronesia. It is not only known in the Marshalls, but is reported from Ponape (*mailap*), the Gilbert Islands (*matinaba*, possibly Capella) and the neighboring Polynesian atolls of Nukuoro (*mailapa*, *mairapa*), Kapingamarangi (*mairap*, Aquila-Altair), Nuguria (*melapa*), and Nukumanu and Ontong Java (*mailapa*, Altair).² The rising and setting of its main star, Altair, indicate due east and west on the central Carolinian compass, in which east, not north, is the basic direction. The people of Sonsorol call their solar year after the name of this constellation, and its name is associated with a month in every calendar reported from the Central Carolines Language Area. While the same name does not appear in Polynesia proper; such epithets as "pillar of heaven" reflect a similar importance attached to Altair.

The meaning of the name is obscure. It is the "main **maa*," which may be "main cluster" if the Hawaiian constellation *humu-ma*, "humu-fish cluster" (Makemson, 1941: 212) contains a cognate element.

As they appear in the Central Carolines Language Area, the various forms of the name present a problem. In the southwestern islands, for example, the Tobian *masirap* equates perfectly with the Trukese *määnap*, but the *maütöp* of Sonsorol, Pulo Anna, and Merir contains an unexpected "t" instead of the expected "r". These forms, moreover, together with that from Tobi, would lead us to anticipate that **masilap* would be the Ulithian name instead of the actual *mailap* reported.³ Whether we are dealing with loan words in some instances or with dialect differences as yet imperfectly understood remains an unsolved problem.

Positions 11 and 23. The rising and setting of Delta, Epsilon, and Zeta Orionis (Orion's belt), called by the natives *jönywēn*.

A. 1c. alual (Aldebaran), 2. eelluel (seven main stars of Orion), 3. eluel (Orion's belt), 8. aliel, ēliel (Orion), 9. elüuel (Orion's belt), 10a. elüuel (Orion's belt), 11a. elüel (Orion), 13a. erüöl (Orion's belt), 13b. elieli, 14. öliöl (Orion's belt), 16. elüuel (Orion's belt), 18. eliol, oliel, 19a. illiül, 20a. eliel, yelyel (belt and sword of Orion), 20b. yeliyel, 21a. öliöl (Orion), 21b. eliel, yelyel (belt and sword of Orion), 22. erüar, 23. erür, 24. jerüar.

B. 1a. jönywēn, 6. enuen, 7. öliöl, 10b. eliel (Orion's belt), 11b. oliel (Orion and Rigel), 12. üliül (Orion's belt), 15. eliol, 17. elüuel (Aldebaran), 19b. eliel, 21c. ilul, 25. ierier.

The two identifications with Aldebaran, both apparently by Krämer, are clearly in error. Aldebaran's declination is impossible for this compass position south of Altair. There can be no question but that here we are dealing with Orion's belt.

¹There is confusion here between the "arms" of the constellation *määnap* and those of *maan*, "the bird." The declinations of the latter make them unsuitable as indicators of positions 8 and 10 on the compass.

²See Gimble (1924: 135), Eilers (1934: 143, 299), Thilenius (1902: 85), Sarfert and Damm (1929: 187-95).

³Cf. Tobian *pisi* (my brother), Pulo Anna *wiŋi*, Ulithian *bwisi*, Trukese *pwüj*. The same problem occurs in connection with the dialects of Fais, Elato, Lamotrek, and Woleai.

The name *jēnywēn* means "young man" in Trukese, and this is the meaning for the constellation's name given by Girschner for Namoluk (3). Its obvious identification with the three stars in Orion's belt, however, and the fact that these stars are called *tolu* (three) in Futuna and *tau-toru* by the Maori and Moriori (Makemson, 1941: 260, 262), all make it tempting to accept Christian's (1899: 390) etymology and to derive the Carolinian name from the word for "three", whose doubled form in Trukese would indeed be **jēnywēn* (from *jēn*) and would mean "threesome" or "trio." There are difficulties with this interpretation, however; the Trukese *jēn* (three) is cognate with the Polynesian *tolu* or *toru* and Tobian *ser*.¹ We would, therefore, expect the constellation to be **seriser* in Tobian instead of the obtained *jeriier*. We have a similar problem in connection with the form of the name on Ulithi and its neighboring atolls. Either the derivation from the word "three" is incorrect, or the name encountered in the western islands is a loanword from the dialects of the eastern islands after the loss of the consonant in the latter. If such is the case, this name may serve to provide concrete evidence as to the direction of the diffusion of at least some aspects of central Carolinian astronomy. Similar problems already noted in connection with the star-names *māānap* and *wykyn iik* point in the same direction.

Further complications are added by the Marshallese name for the three stars in Orion's belt (Erdland, 1914: 80). Here the constellation includes the additional star Sigma Orionis and is called *jiljil*, "adze," which superficially looks like a cognate of the Carolinian names. But Marshallese "j" normally corresponds to Trukese "s" and the corresponding form for adze in Trukese appears in the word *sene* (adze). This does not preclude an original common origin for the Carolinian and Marshallese names, which may have been corrupted in time, reinterpreted through popular etymologies, and analogically modified further to fit the reinterpretations.

Finally, the name for Orion's belt in Tonga is *alotolu*, meaning "three-oared boat" or "three in a boat" (Collocott, 1922: 160). It is quite possible that the Carolinian name was originally the same and that *jēnywēn*, instead of being the doubled form of **jēny*, is derived from a compound of two distinct roots, as in *alotolu*.

Positions 12 and 22. The rising and setting of Corvus, **serepwēn*. Which star in Corvus is the key one for the compass cannot be determined from existing evidence. The native constellation also includes Spica (α Virginis).

A. 1c. sarebol (Orion's belt), 2. soroopuel ($\alpha, \beta, \gamma, \delta, \epsilon$ Corvi),² 3. saropwil (Corvus), 8. arebol, sarebol,³ 9. hārebol (Corvus), 10a. serewol (Corvus), 11a. sarabol, 13a. djerewol (Corvus), 13b. sarabwol, 14. θarawuon, 16. serewol, 18. sarebol, sarevol, 19a. θarugol, 20a. sorovol (Corvus ?), 20b. sarabul, 21a. θeruwon (Corvus), 21b. sorovol (Corvus ?), 22. talowor, 23. talawor, 24. taiglovar (Orion).

B. 1b. serepwōn ("open up the surface"), 11b. sor-a-bol (Corvus, "viewer of the taro patches"), 12. θare u ol (Corvus), 15. saravol, 17. serewol (Orion), 19b. saravul, 21c. θerewol.

The name clearly refers to Corvus. Evidence for the inclusion of Spica in this constellation will be presented in discussing the next position on the compass. Identification with Orion on Truk (1c), Sorol (17), and Merir (24) may represent confusion by ethnographer or informant with the previous compass position. In the case of Sorol, we know that none of the natives knew either the old astronomy or navigation, remembering only those star-names which were used in the calendar, but not their correct order or identity (Damm, 1938: 250).

Reported for Ponape as *θaarebol*, the name also occurs on Nukuoro (*sarapori*, *sarapoli*), Kapingamarangi (*herapol*, Corvus), and possibly Nukumanu (*nahalapolu*, α and β

¹See Dyen (1949: 435) for the derivation of Trukese *jēn* from an earlier **telu*. The history of the star-name would be from **telutelu* to **eluelu* to **jēlywēly* to **jēlywēl* to **jēnywēn*.

²Kubary's informant inserts a constellation called *pešeeylan* (unidentified) between *jēnywēn* and **serepwēn* in the Mortlockese compass and compensates by omitting what in other compasses appears as position 16.

³Krämer's informant actually reverses the names for this position and the next one in the compass reported from Pulap, putting *tumuur* ahead of **serepwēn*.

Centauri) and Ontong Java (*ngahalapolu*, Capella and Auriga).¹ The name is not reported from other parts of Micronesia nor from Polynesia proper. Its meaning is not clear.²

Positions 13 and 21. The rising and setting of Antares (α Scorpii) in the native constellation *tumwur*. The distributional evidence is as follows:

A. 1c. tungur, 2. tumur (Antares), 3. tuumur (Antares), 8. tumur (Antares),³ 9. tumur (Virgo), 10a. tumul (Virgo), 11a. tumur (Antares), 13a. dumul (Virgo), 13b. tumuura, 14. tumur (Virgo), 16. dumur (Virgo), 18. tumur, 19a. θ umur, 20a. duumur (Antares ?), 20b. thamur, 21a. θ umur (Antares), 21b. duumur (Antares ?), 22. tumugl, 23. tuumul, 24. tumugl.

B. 1a. tumwur, 1b. tumur ("finished" as of food), 1d. pumur, 4. tumur, 5. tumur, 7. tumur, 10b. toumour (Virgo and Antares), 11b. tumur (Antares), 12. tumul (Antares), 15. tumur, 17. dumul (Ursa major), 25. tuumu.

The identifications with Virgo (9, 10a, 13, 14, 16) were all apparently made by the same ethnographer, Sarfert, and are to be discounted in the face of consistent identifications by others with Antares. The declination of Virgo precludes its serving as an indicator of this compass position, whereas that of Antares is suitable. Spica Virginis is, moreover, named by Hambruch for Elato (12) as *gapi θ areuol* (Trukese: **jepiserepwën*), "tail" or "end of Corvus," and by Kubary for the Mortlocks (2) as *aapin soropuel* ((Trukese: **jepin serepwën*). This appears in abbreviated form as the Trukese star-name *jäap*, whose place in the calendar argues a right ascension like that of Spica. Another part of Virgo (ν , π , ρ) is reported for the Mortlocks (2) as *iannelikak*. These considerations lead to the conclusion that *tumwur* is properly identified with Antares in Central Carolinian astronomy. This conclusion is supported by data from the Marshalls, where Erdland (1914: 79) equates *dūmur* with Antares in a larger constellation of the same name including Sigma and Tau Scorpii. The name also has its counterpart on Ponape (*tšuumur*), Nukuoro (*tumuru*), and Kusaie (*tumur*, variously identified as Crux and Venus).⁴ While the same name is not reported from Polynesia, Antares plays an important role in its astronomy (Makemson, 1941: *passim*).

Positions 14 and 20. The rising and setting of a constellation in the tail of Scorpio, possibly Lambda and Kappa, or in Lupus. The native name is **mesarë*, or possibly **mesëryw*.

A. 1c. mesaru, 2. mesažeu (β , γ , δ , ϵ Leporis and χ Centauri), 3. mesaren (Lepus), 8. no name given, 9. mhāru, 10a. māsāru, 11a. metari, metariu (Scorpio, but rising later than Antares), 13a. mādālū, 13b. metaarua, 14. metaru, 16. medāruu, 18. matarei, metari, 19a. matari, ma θ ari, 20a. mataroi (Scorpio ?), 20b. metarei, 21a. metarūū (Scorpio), 21b. matarei (Scorpio ?), 22. matagli, 23. metali, 24. mātāgli.

B. 6. mesarō, 11b. met-a-ryo (Scorpio, "two-eyes"), 12. meta riu (Scorpio), 15. metaru.

The few identifications are consistently with Scorpio except for the Mortlocks (2) and Namoluk (3). The description in the former case linking Lepus with Chi Centauri suggests that ethnographers may have confused Lepus with Lupus. Lepus and Centaurus cannot be seen as one constellation, but Lupus and Centaurus can. Lupus has the same declination as does the tail of Scorpio, but the declination of Lepus is wrong for this position in the native compass. This constellation, therefore, is to be identified with the tail of Scorpio and/or Lupus. The "tail" is indicated by the fact that the previous compass position is designated by Antares in the "head" of Scorpio.

The meaning of the name is not clear. If Christian's interpretation for Lamotrek (11b) as "two-eyes" is correct, then the Trukese form of the name should be **mesëryw*, with

¹See Hambruch (1936: 156-9), Eilers (1934: 143, 299), Sarfert and Damm (1929: 187-95).

²The name is compounded from two roots, **sere-/sara-* and **pwën*. The first is possibly related to Polynesian *tara* (rays), a common element in Polynesian star-names (Makemson, 1941: 256-7), and the Trukese word *saram* (bright, shining). The second root may be related to the Polynesian *polo* (shining), which also appears in star names (Makemson, 1941: 245).

³Actually reversed in order with the preceding position in the Pulap compass (see page 13, footnote 3 above).

⁴See Hambruch (1936: 156-9), Eilers (1934: 299), Sarfert (1919: 223).

Kappa and Lambda Scorpii likely candidates. Indeed, Erdland (1914: 79) reports *lemejrikrik*, "the little-eyed," as the Marshallese name of a comparable constellation ($\lambda, \upsilon, \kappa, \iota$ Scorpii), though in Trukese this name would be **mesecik*. Evidence in favor of **mesarē*, on the other hand is provided by the Gilbertese cognate *mataroa*, there identified with Spica (Grimble, 1924: 135). Cognate with the Marshallese name is the form *metarik* (Scorpio) reported for Kapingamarangi by Eilers (1934: 143), which in turn is cognate with the Polynesian *matariki* or *mataliki*, which usually designates the Pleiades (Makemson, 1941: 232).

Positions 15, 16, 17, 18, and 19. The rising, setting, and intermediate positions of Crux, **pwuupw* (trigger fish). The intermediate positions are named for what are probably adjacent stars in Centaurus, **māce*. We shall present the evidence for all positions before attempting to discuss them.

Positions 15 and 19 are marked by the rising and setting of **pwuupw*, and are called **tāanupw* and **tupwunupw* or **tonenupw* respectively.¹

A. 1c. tanup, tolen tanup (Sirius, "standing deep"), 2. teenup (Crux rising) or faalulās (α, β , Centauri), 3. tānup or faluulol (Crux rising), 8. galu (apparently a corruption of tagalup), 9. daanup, tolonup, 10a. dagalup, tubulup, 11a. tagal lup, lupu (a star 27 degrees from the south pole, i.e., ? Crucis), 13a. dagalipu or dagalip, dubulūp, 13b. taga l' ipu, tubwu l' ipu, 14. taxalup, tubuluup, 16. dagalipu, 18. tagalup, tubulup, 19a. θagill up, θolol up, 20a. θagi-luuv, θolol luuv (Crux and α, β Centauri), 20b. thagalu,² 21a. θeglūp (Crux rising), 21b. θagi-luuv, θolol luuv (Crux and α, β , Centauri), 22. woou, 23. woowe, 24. woowo (Crux).³

B. 6. tānup, 10b. tōātoub (Crux), 12. tubul buup (Crux setting), 15. tagalup or tagalu (a southern star rising), tubulup (the same setting).

Positions 16 and 18 are called **māce me/meji jaas* in the east and **māce me notow* or **māce me/meji ton* in the west. They are indicated by Crux at an altitude of about 45 degrees in the east and west respectively though the name **māce* seems to refer to Alpha and Beta Centauri.

A. 1c. matemeas (Sirius, higher), matemelodau,⁴ 2. not given in the compass, 3. maθamaθeas, maθamaθ me loxuu or faluvas (Crux higher in east and same in west), 8. name lacking, 9. madjemehat, madjemelodo, 10a. mādjemaias, mādjemailodo, 11a. medje meiet, madjemeitol, 13a. medjemaiad, madjemeitol, 13b. metremeiat, metremeital, 14. lacking, 16. lacking, 18. lacking, 19a. merimeit, mari meitol, 20a. maramaiat, maramatal, 20b. lacking, 21a. maremeiwot (Crux higher in east), meitol, 21b. maramaiat, maramatal, 22. māāli, 23. māāl, 24. māgl (α, β Centauri).⁵

B. 2. maažemeniyaas, maažemenlootou (positions of Crux), 5. madja mēsor, 6. māchemeias, 12. matsumeiit (southern point of Crux), 15. mat or magementiat (southern star 45 degrees up in east), madjemeitol (same, 45 degrees up in west).

Position 17 is marked by Crux at the meridian or in upright position and is called *wenewen* (Cf. the names for compass position 1), or in some instances **wenewen ēēr* (southern *wenewen*), **wenewenenupw* or **wenewenen pwuupw* (*wenewen* of **pwuupw*). It marks due south on the compass.

A. 1c. veneven, vonovon, 2. aionouan (Crux at meridian), 3. wonau won or faluwoθ (Crux upright), 8. volevol, 9. wonewon, 10a. wolewolup, 11a. volevol iaur, 13a. wolewolelūp, 13b. wōlwōl li auuru, 14. oluul le luup, 16. wolewol elibu, 18. volevol, 19a. ulu'ul jeūr, 20a. wonowon luuv (Crux), 20b. wonowon-le-yor (the southernmost star), 21a. onoon izūr (Crux upright), 21b. wonowon luuv (Crux), 22. werāāweri (Crux), 23. werawer, tawoneng (Crux upright), 24. worouwere, tawoneng (Crux).

¹Eastern positions on the compass are indicated in the Central Carolines by use of the word *tāā-n* (rising-of) before the name of the appropriate star. Common dialect variations are *dai-li* and *taga-l* (See table 1). For positions in the west we find *tupwu-n* or *tone-n* (setting-of).

²Actually reversed in order with the preceding position.

³The last three names are cognates of **pwuupw*.

⁴*Tolen matemeas* is also given in this source as occurring between positions 19 and 20.

⁵There are two additional compass positions between 16 and 17 reported for Sonsorol, Pulo Anna, and Merir.

B. 1a. wenewen (Crux), 1b. wenewen (Crux), 11b. uiluil-al-eaur (Crux), 15. volevol, velavel (southern star at meridian).

For the constellation **pwuupw* as such, without reference to its positions, we also find the following distribution:

B. 7. pub, 9. buub, 11a. bup (Crux), 11b. pup (Crux, "leather-jacket fish"), 12. buup (Crux), ip al buup (? Centauri), 24. woowo (Crux).

It is clear from the evidence that the name for Crux in compound terms indicating compass positions 15 and 19 is variously rendered as *-p*, *-pu*. The preceding "u" or "i" is the stem vowel of the preceding possessive element (Trukese *-ni-*, but *-nu-* when followed by "u" in contact with a labial consonant, see Dyen, 1949: 431). Thus we may reconstruct Krämer's *tanup* for Truk (1c) as **tāā-nu-pw* < **taxa-ni-pu*, "the rising of **pu*." The name **pwuupw* can be analyzed as the doubled form of the same root **pu*, which would be **pupu*, and which by loss of the final vowel and compensatory lengthening of the first vowel (Dyen, 1949: 421-3) would produce Trukese **pwuupw*. In this connection, Elbert (1947: 265) gives the following Trukese names for the trigger fish: *pup* (**pwuupw*), *pupuōch* (**pwupwu-jēēc*). This agrees with Christian's translation of the constellation's name as "leather-jacket fish" for Lamotrek (11b), and his identification (1899: 353) of *pup* on Ponape with the same species of fish. Final corroboration for this interpretation is supplied by Erdland (1914: 85), who identifies the Marshallese constellation *bub* (Crux) with a fish of the same name.¹

This identification provides a clue to the meaning of the names for compass positions 16 and 18, which also clearly have to do in some way with Crux. They describe the position of **māce* as "up" or "east" and "west" or "remote." The trigger fish is characterized by a dorsal spike which locks stiffly upright when he is attacked and hinders his being swallowed. The term **māce* may well refer to this spike, as suggested by the name for the bony "stinger," *mācew*, in the sting-ray's tail. If we think of Alpha and Beta Centauri as the tail of the fish, then Gamma Centauri would form its spike, and positions 16 and 18 would be indicated by its location in relation to Crux. If we confine the trigger fish constellation to Crux itself, Gamma Crucis would serve the same purpose. Another possibility, which perhaps has greater merit, is that **māce* means "spear" (the sting-ray's tail bone is used as a spearhead by the natives, and we have the Marshallese cognate *mare* in the name of a constellation in Draco, *mare eo an aolōt*, "spear of the *aolōt*-fish," as reported by Erdland, 1914: 78). This interpretation would confine **pwuupw* to the stars in Crux alone and make Alpha and Beta Centauri the spear on which the trigger fish is transfixed. In any event, the arrangement of the stars involved is such that position 16 is roughly defined by the location of Crux at the rising of Alpha Centauri, and position 18 is defined by the location of Crux when Alpha Centauri passes just to the west of the meridian. At these two points any of the above possibilities conform to our data, so that we may illustrate compass positions 15-19 as shown in Figure 3.

¹The writer recently recorded *te bubu* as a native name for the trigger fish in the Gilbert Islands.

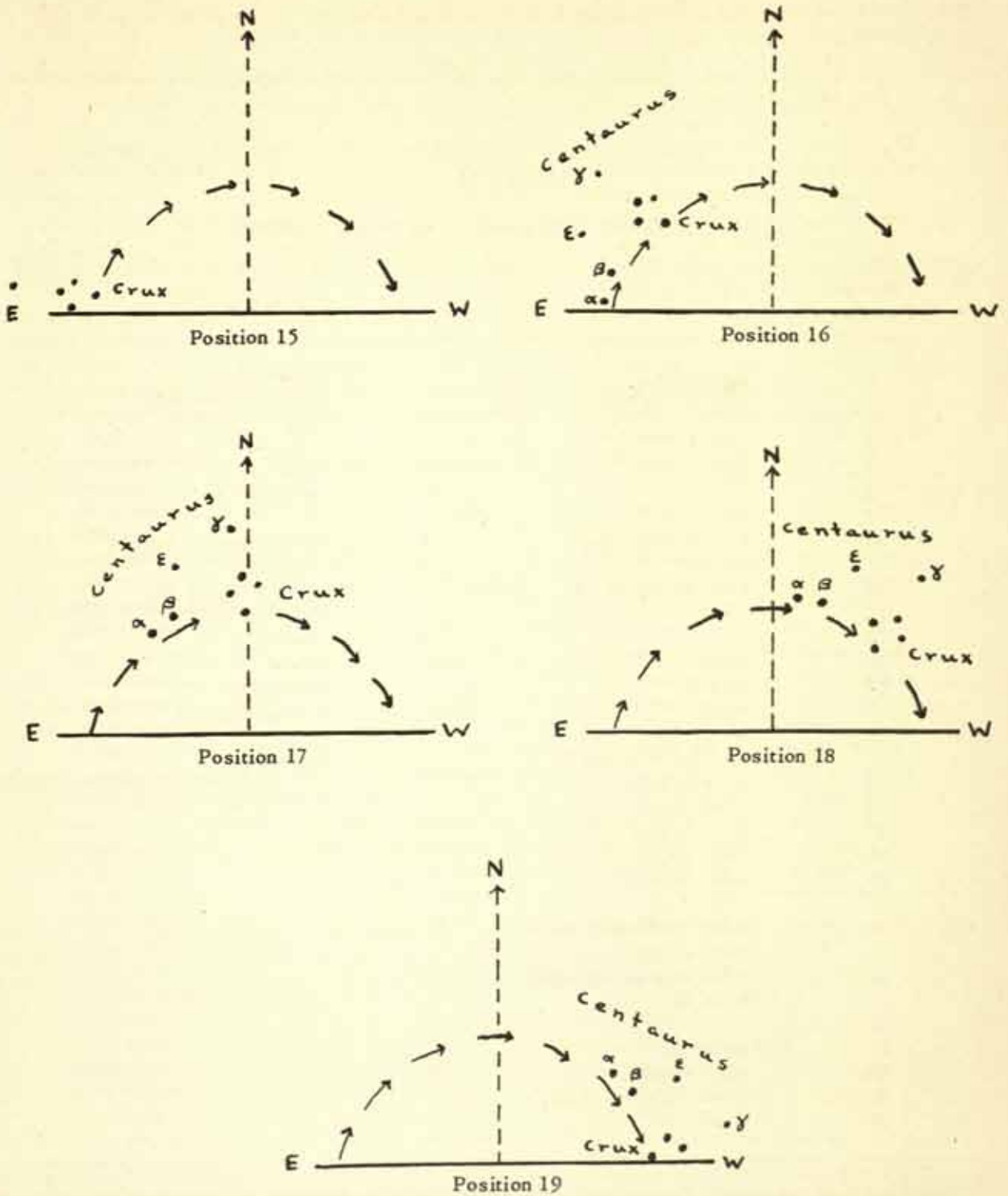


Figure 3. The Southern Cross at Compass Positions 15-19.

TABLE 1.

Comparison of Sidereal Compasses in the Central Carolines

| <i>Compass Position</i> | <i>Truk (1c)</i> ¹ | <i>Mortlocks (2)</i> ² |
|-------------------------|-------------------------------|-----------------------------------|
| 1. | fusamokit | fyysamakit |
| 2. | meilap en efang | meeylap en eeffeng |
| 3. | uona | oola |
| 4. | ukenik | ūken ik |
| 5. | man | moel |
| 6. | un | meeriker |
| 7. | moeriger | uun |
| 8. | baun meilap efang | pooun maan me eeffeng |
| 9. | meilap | meeylap |
| 10. | baun meilap mē eor | pooun maan me yer |
| 11. | alual | eelluel |
| 12. | sarebol | soroopuel |
| 13. | tungur | tuumur |
| 14. | mesaru | meesažeu |
| 15. | tanup | teenup, faalūlaš |
| 16. | matemeas | . . . |
| 17. | veneven, vonovon | aioonouan |
| 18. | mate melodau | |
| 19. | tolen tanup | |
| 20. | tolen mesaru | |
| 21. | tolen tungur | |
| 22. | tolen sarebol | |
| 23. | tolen alual | |
| 24. | tolen baun meilap mē eor | |
| 25. | tolen meilap | |
| 26. | tolen baun meilap efang | |
| 27. | tolen un | |
| 28. | . . . | |
| 29. | tolen man | |
| 30. | tolen ukenik | |
| 31. | tolen meilap en efang | |
| 32. | tolen uona | |

¹Nos. 6 and 7 are juxtaposed. Two positions, *tolen veneven* and *tolen matemeas* are interpolated between nos. 17 and 18 and between 19 and 20 respectively. Nos. 31 and 32 are juxtaposed, and no. 32 is followed by the superfluous *tolen fusamokit* (setting of Polaris).

²A position called *pešeeylam* is interpolated between nos. 11 and 12.

| <i>Namoluk</i> (3) | <i>Pulap</i> (8) ¹ | <i>Puluwat</i> (9) |
|---------------------------|-------------------------------|------------------------|
| fuusa mokit | fuumaket | fii he magid |
| taen meilap en efang | mailupelefang | daane mailöb bälëfang |
| taen oala | . . . | daane wole |
| taen uuk en iik | ugulik | daane ugeniik |
| taen moal | möl | daane mööl |
| taen mweriker | moiriger | daane mariger |
| taen uun | un | daan uun |
| taen paun maan me efang | . . . | daane baiifang |
| taen meilap | däl mailap | daane mailöb |
| taen paun maan me yer | . . . | daane baijoor |
| taen oluuel | aliel | daane elüüel |
| taen saropwil | tumur | dai härebol |
| taen tuumur | arebol | dai tumur |
| taen mesaren | mareg | daane mhāru |
| tānuup, faluulol | galu | daanup |
| maθamaθeeeaθ, maθamaθeeas | . . . | madjemehat |
| wonau won, faluwoθ | volevol | wonewon |
| maθamaθ me lotuu, faluwas | . . . | madjemelodo |
| . . . | galu | dolonup |
| tolon mesaren | mareg | doloni mhāru |
| tolon tuumur | sarebol | doloni tumur |
| tolon saropwil | tumur | doloni härebol |
| tolon oluuel | ēliel | doloni elüüel |
| tolon paun maan me yer | . . . | doloni baijoor |
| tolon meilap | toron e mailap | doloni mailöb |
| tolon paun maan me efang | . . . | doloni baiifang |
| tolon uun | toron un | dolon uun |
| tolon mweriker | moeriger | doloni mariger |
| tolon moal | möl | doloni möl |
| tolon uuk en iik | ugulik | doloni ugeniik |
| tolon oala | . . . | doloni wole |
| tolon meilap en efang | mailup elefang | doloni mailöb bälëfang |

¹This is an obviously corrupt list. No. 14, *mareg*, may be anything, but probably corresponds in name either to no. 14 or no. 16 of the other lists. Nos. 12 and 13 are in reverse order as are nos. 21 and 22; and no. 32 is followed by the superfluous *dolel fuumaket*. In this connection it should be noted that it was Krämer who recorded this as well as the Trukese list where the same peculiar "setting of Polaris" appears.

(Table 1, continued)

| Compass Position | Satawal (10a) | Lamotrek (11a) ¹ | Ifalik (13a) |
|---------------------|------------------------|-----------------------------|-------------------------|
| 1. | fii si magid | volevol iefang | wolewole |
| 2. | daili mailöb bārāfang | mailap ale fang | dagaali mailöb balewāng |
| 3. | daili olāgo | volēgo | dagaali olāāgo |
| 4. | daili ugelüik | ūgulūg | dagaali uge liik |
| 5. | daili möl | maal | dagaali mööl |
| 6. | daili legir | magariger | dagaali mariger |
| 7. | daili uul | tagalul | dagalulul |
| 8. | daili baiifang | . . . | . . . |
| 9. | daili mailöb | mailap | dagaali mailöb |
| 10. | daili baijoor | . . . | . . . |
| 11. | daili elüüel | tangali elüel | dagaali erüöl |
| 12. | dai serewol | . . . | dagaali djerewol |
| 13. | dai tumur | tumur | dagaali dumul |
| 14. | daali mäsāru | metari | daali mādālū |
| 15. | dagalup | tagal lup | dagalipu |
| 16. | mādjemaias | medje meiet | mādjemaijad |
| 17. | wolewolup | volevol iaur | wolewolelülüp |
| 18. | mādjemailodo | mādjemeitol | mādje maidal |
| 19. | dubulup | lupu | dubulüp |
| 20. | dubuli mäsāru | metaru | dubuli mādālū |
| 21. | dubuli tumur | tumur | dubuli dumul |
| 22. | dubuli serewol | sarabol | dubuli djerewol |
| 23. | dubuli elüüel | tubul alüel | dubuli erüöl |
| 24. | dubuli baijoor | . . . | . . . |
| 25. | dubuli mailöb | tubule mailap | dubuli mailöb |
| 26. | dubuli baiifang | . . . | . . . |
| 27. | dubuli uul | ul | dubulewul |
| 28. | dubuli mariger | magariger | dubuli mariger |
| 29. | dubuli möl | mēl | dubuli mööl |
| 30. | dubuli uge liik | ūgulūg | dubuli uge liik |
| 31. | dubuli olāgo | voelēgo | dubuli olāāgo |
| 32. | dubuli mailöb bārāfang | mailapalefang | dubuli mailöb balewāng |

¹The inconsistencies of spelling native names even within the same list and presumably from the same informant, the omission of *sarabol* at no. 12 but its inclusion at no. 22, all testify to the hastiness with which this list was recorded in the field.

| <i>Ifalik</i> (13b) | <i>Faraulep</i> (14) ¹ | <i>Eauripik</i> (16) ² |
|---------------------------|-----------------------------------|-----------------------------------|
| wólwól li ievang | oluuol el ijefang | wolewole |
| taga li mailap e li vang | tagali mailop | mailöb bārāwāng |
| taga li wileugo | uolāgor | wolago |
| taga li ugiliik | ugeliiga | ugeliik |
| taga li mēél | mal | maal |
| taga li megarigari | marægiri | maregiir |
| taga li uulu | oul | uul |
| taga li pau ievang | . . . | . . . |
| taga li mailap | mailap | mailöb |
| taga li pau iauru | . . . | . . . |
| taga li elieli | öliöl | elüüel |
| taga li sarabwol | θarawuon | serewol |
| taga li tumuura | tumur | dumur |
| taga li metaarua | metaru | medāruu |
| taga l' ipu | tubuluup | dagalipu |
| metremeiat | matjomaidan | madje maidol |
| wólwól li iauru | oluuol le luup | wolewol elibu |
| metremeital | matjomaia ^θ | |
| tubwu l' ipu | taxaluup | |
| tubwu li metaarua | taxal metaru | |
| tubwu li tumuura | taxal tumur | |
| tubwu li sarabwol | taxal θarawuon | |
| tubwu li elieli | taxal öliöl | |
| tubwu li pau iauru | . . . | |
| tubwu li mailap | tubul mailop | |
| tubwu li pau ievang | . . . | |
| tubwu li uulu | tubul oul | |
| tubwu li megarigari | tubul u marægiri | |
| tubwu li mēél | tubul ule mal | |
| tubwu li ugiliik | tubul ugeliga | |
| tubwu li wileugo | tubul uolāgor | |
| tubwu li mailap e li vang | tubul e mailop baliefang | |

¹Nos. 15 and 19 are reversed as are nos. 16 and 18. Nos. 20-23 should be with *tubul* (setting) instead of *taxal* (rising).

²No. 16 belongs where no. 18 would be. Only rising or eastern positions are reported.

(Table 1, continued)

| <i>Compass Position</i> | <i>Fais (18)¹</i> | <i>Ulithi (19a)</i> | <i>Yap (20a)</i> |
|-----------------------------|------------------------------|---------------------|---------------------------------|
| 1. | fisimagut | ulu'ul jefang | wonowon ni mailap |
| 2. | θagali mailapel efang | θagillimailop | θagil ii mailap lafang |
| 3. | tagal uelego | ologor | θagil ii uelōgo |
| 4. | tagali egelik | igillük | θagil ii uugenig |
| 5. | tagali mōn | moom | θagil ii mol |
| 6. | tagali magereger | marregir | θagil ii magiregir |
| 7. | tagal uun | ul | θagil ii wun |
| 8. | . . . | . . . | pol ii mailap maiefang |
| 9. | tagali mailap | mailop | θagil ii mailap |
| 10. | . . . | . . . | pol ii mailap meyor |
| 11. | eliol | θagill illi ül | θagil ii eliiel (yelyel) |
| 12. | sarebol | θagill θarugol | θagi sorovol |
| 13. | tumur | θagill θumur | θagid duumur |
| 14. | metarei | θagill i matari | θagil ii mataroi |
| 15. | tagalup | θagill up | θagi-luuv |
| 16. | madjemeiet | marimeiit | maramaiat |
| 17. | volevol | ulu'ul jeürr | wonowon luuv |
| 18. | madjemeitol | mari meitol | maramatal |
| 19. | tubulup | θolol up | θolol luuv |
| 20. | tubulemetarei | θolol meθari | θolol ii mataroi |
| 21. | tubutumur | θolol u θumur | θolo duumur |
| 22. | tubusarevol | θolol θarugol | θolo sorovol |
| 23. | tubulioliei | θolol illiül | θolo ii eliiel |
| 24. | . . . | . . . | θolol ii pol ii mailap |
| 25. | tubulemailap | θolol i mailap | θolol ii mailap |
| 26. | . . . | . . . | θolol ii pol ii mailap maiefang |
| 27. | tubuluul | θolol uul | θolol ii wun |
| 28. | tubulemagereger | θolol marregir | θolol ii magiregir |
| 29. | tubulemöl | θolol i mol | θolol ii mol |
| 30. | tubuliegelik | θolol igillük | θolol ii uugenig |
| 31. | tubul uelōgo | θolol ologor | θolol ii uelōgo |
| 32. | tubumailapelefang | θolol i mailop | θolol ii mailap lafang |

¹Krämer's list shows no. 13 coming before no. 9, an error which we have corrected here since Krämer has its counterpart, no. 21, in the correct place.

| <i>Yap</i> (20b) ¹ | <i>Ngulu</i> (21a) ² | <i>Sonsorol</i> (22) ³ |
|-------------------------------|---------------------------------|-----------------------------------|
| . . . | θolol onoon | werääweri |
| mai-le-palafal | θolol mailop palefang | maiteperāwāng |
| ulagok | θolol mailop pali olox | woroox |
| yigelik | θolol ugenix | igriäg |
| moul | θolol moon | mauri |
| magirigir | θolol mar geregir | marailigeegl |
| un | θolol un | uur |
| . . . | . . . | . . . |
| mai-lap | θolol mailop | māθitöp |
| . . . | . . . | . . . |
| yiliyel | θolol öliöl | erüar |
| sarabul | θolol θeruwon | talowor |
| thamur | θolol θumur | tumugl |
| thagalu | θolol metarüü | metagli |
| matarei | θolol θagelüüp | woou |
| . . . | θolol maremeiwot | määli |
| wonowon-le-yor | θolol onoon izür | werääweri |
| . . . | θolol meitol | |
| tholon-a-wonowon | θolol θagelüüp | |
| tholon-a-matarei | θolol metarüü | |
| tholon-a-sarabul | θolol θumur | |
| tholon-a-thamur | θolol θeruwon | |
| tholon-a-yiliyel | θolol öliöl | |
| . . . | . . . | |
| tholon-a-mailap | θolol mailop | |
| . . . | . . . | |
| tholon-a-wun | θolol un | |
| tholon-a-magiregir | θolol mar geregir | |
| tholon-a-moul | θolol moon | |
| tholon-a-yigelik | θolol ugenix | |
| tholon-a-ulagok | θolol mailop pali olox | |
| tholon-a-mai-le-palafal | θolol mailop palefang | |

¹Nos. 14 and 15 are reversed. Christian actually reports no. 27 between *tholon-a-thamur* and *tholon-a-yiliyel*, an error we have corrected because he puts its counterpart, no. 7, in the correct place. Nos. 21 and 22 are reversed.

²The use of *θolol* (setting) to describe every position in the compass is a peculiar departure from the usual. Either the ethnographer is in error here, or his informant, unaware of the meaning of the word, which is foreign to the speech of Ngulu, has given a bastardized version of the compass.

³Between nos. 1 and 2 are two additional positions, *ifangefang* *θaupite* and *ifangefang*. There are two extra positions between nos. 16 and 17, also, called *maθawure* and *määli tamaar*. Only the rising or eastern positions are reported for the Sonsorol compass.

(Table 1, continued)

| <i>Compass Position</i> | <i>Pulo Anna (23)¹</i> | <i>Merir (24)²</i> |
|-----------------------------|-----------------------------------|-------------------------------|
| 1. | tawoneng | worewoi |
| 2. | mariparāweng | meiteberāseng |
| 3. | woraaxe | woraax |
| 4. | grieg | grieg |
| 5. | maur | mauri |
| 6. | marailigel | marailigegl |
| 7. | uur | uuru |
| 8. | . . . | . . . |
| 9. | maθitōp | māθitōp |
| 10. | . . . | . . . |
| 11. | erūr | jerūuar |
| 12. | talawor | taiglovar |
| 13. | tuumul | tumugl |
| 14. | metali | mātāgli |
| 15. | woowe | woowo |
| 16. | māāl | māgl |
| 17. | tawoneng (werawer) | worouwere (tawoning) |

¹Additional positions between nos. 1 and 2 are *θanggeθang θapite* and *θanggeθang*, while those between nos. 16 and 17 are *māatapur* and *mālitamar*.

²Additional positions between nos. 1 and 2 are *rivanggavang* and *rivanggavang* (the name is the same for each?), while those between nos. 16 and 17 are *māθaupur* and *māogli tamar*.

THE CALENDAR AND ALMANAC

There are several contexts within which natives in the Central Carolines keep track of time. Seasonal variations in the condition of the breadfruit crop, for example, provide the basis for a feast-day calendar on Truk. The phases of the moon have given rise to a thirty-day lunar month, *maram* (moon), each night of which bears a name which is in some way descriptive of the moon's position or appearance. The names used and their sequence are quite similar from island to island in the Central Carolines.¹ The lunar month is divided into three periods, said to be ten days each on Truk. The first, a period of darkness, is feared as the time when ghosts and sorcerers are active. Trukese natives favor the second ten days of relatively full moon during the evening hours for social activities. The lunar month represents the longest day-count kept. For longer periods the calendar is a sidereal one. Concern with forecasting weather conditions appears to have been responsible for its development.

The natives divide the year into a varying number of unequal periods based on the right ascensions of stars. Each of these sidereal months is named for its star, and with each is correlated the prevailing weather, particularly as regards seasonal winds and currents. It is clearly the purpose of this calendar to provide a reasonably reliable almanac for native navigators, to whom its knowledge is largely restricted.

The first appearance of a star in the east just before dawn (its heliacal rising) usually marks the beginning of the sidereal month bearing its name. Local differences in the way these months correspond with our months, however, suggest that different points of reference are sometimes taken. Whatever they are, they are consistent within the framework of any one locality's calendar. With minor exceptions the temporal sequence of star names is the same in all of the islands (Table 2), proof that the calendars are based on relative right ascensions of stars.

The number of sidereal months varies among the islands and the several schools of navigation. Known on Truk, for example, are at least two such schools: that called *Werijeg* with a calendar of fourteen months, and *Fāānuuc* with a twelve month system.² The former is said to have come from Puluwat atoll, where it is associated with the *Sowupwonowöt sib*, and to have for its patron deity the spirit *Peceenuuk* (Middle-Foot). Our informant derives *Fāānuuc* from Pulap, where he associates it with the *Pwēēn sib*. This school reveres *Mwaresi*, a rainbow spirit, as its patron. Given such different schools, it is not surprising that *Bollig* (1927: 207) and the writer obtained calendars of twelve months from the western part of Truk's lagoon, while *Krämer* (1932: 303) and *Elbert* (1947: 289), both of whom worked primarily in Truk's eastern islands, each report calendars of fourteen months. Fourteen months are also reported from Puluwat and Satawal, fifteen months from Namoluk, thirteen from Namonuito, and twelve from the remaining islands, except *Tobi*, which seems to have a calendar of only ten months.

There is also variation in the stars used. In two instances the choice falls between two stars (or constellations) of similar right ascension and there is no calendar which includes them both (Table 2). The remaining differences cannot be explained, as *Bollig* (1927: 207) tries to do, on the grounds that the same stars have different names, for some of the variation involves stars and names which are common to the star compasses of all localities. With the exception of *Crux* (which appears as a month name on Namonuito and Puluwat in place of *Corvus*), all the stars used have declinations which do not greatly exceed the limits set by the extreme north and south points of the ecliptic. By no means all of them lie along the ecliptic, however, and the various calendars show no more resemblance to the zodiac

¹See *Christian* (1899: 392-3, 395) for the days of the month on Lamotrek, the Mortlocks, and Woleai. *Bollig* (1927: 207) reports an almost identical list for Truk. The thirty-day month is as much a common feature of the islands in the Central Carolines Language Area as is their star-lore.

²*Cf. Elbert* (1947: 78, 227).

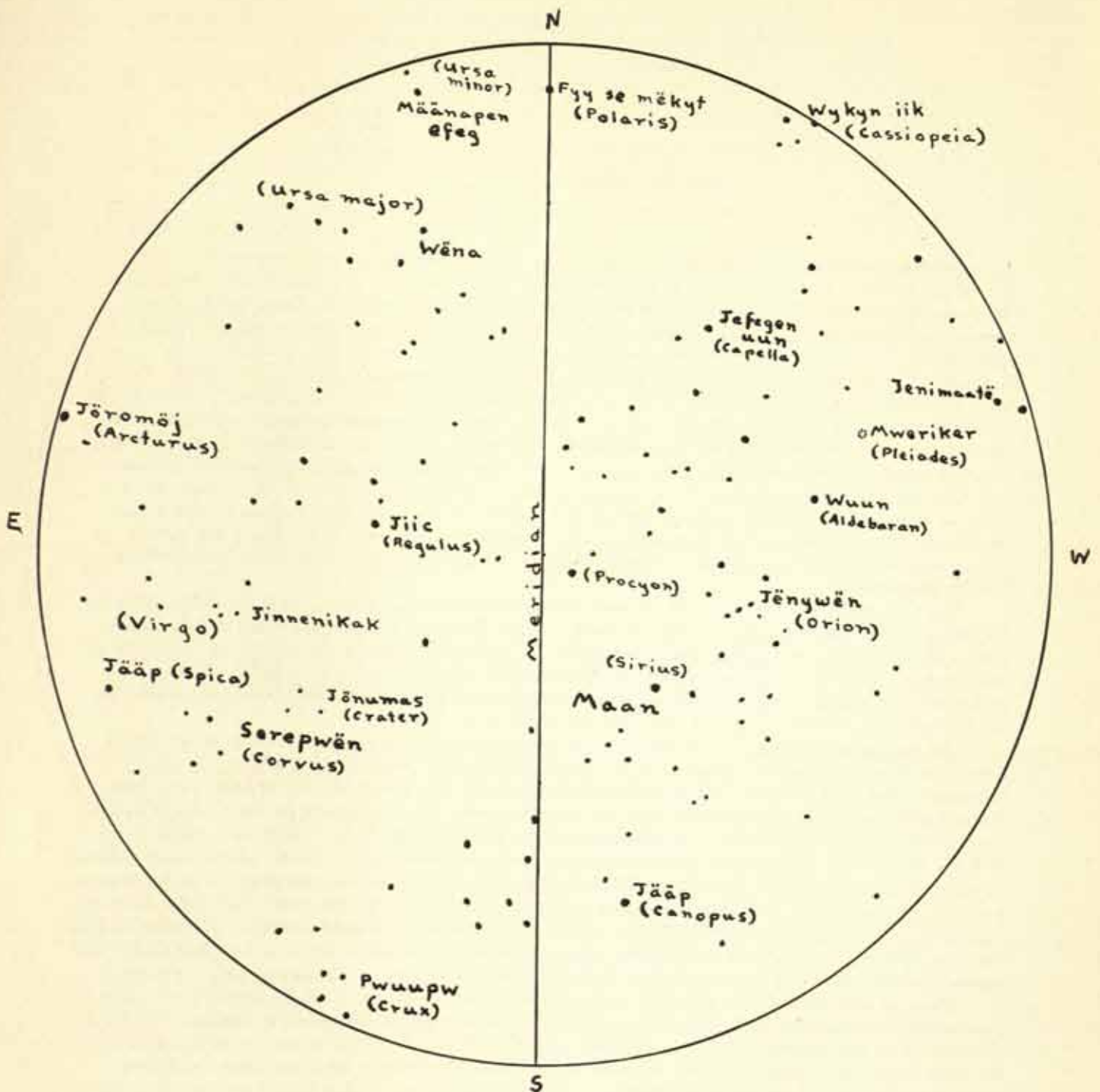


Figure 4. Map of the Stars as Seen from the Central Carolines, 20 Hours at the Meridian.

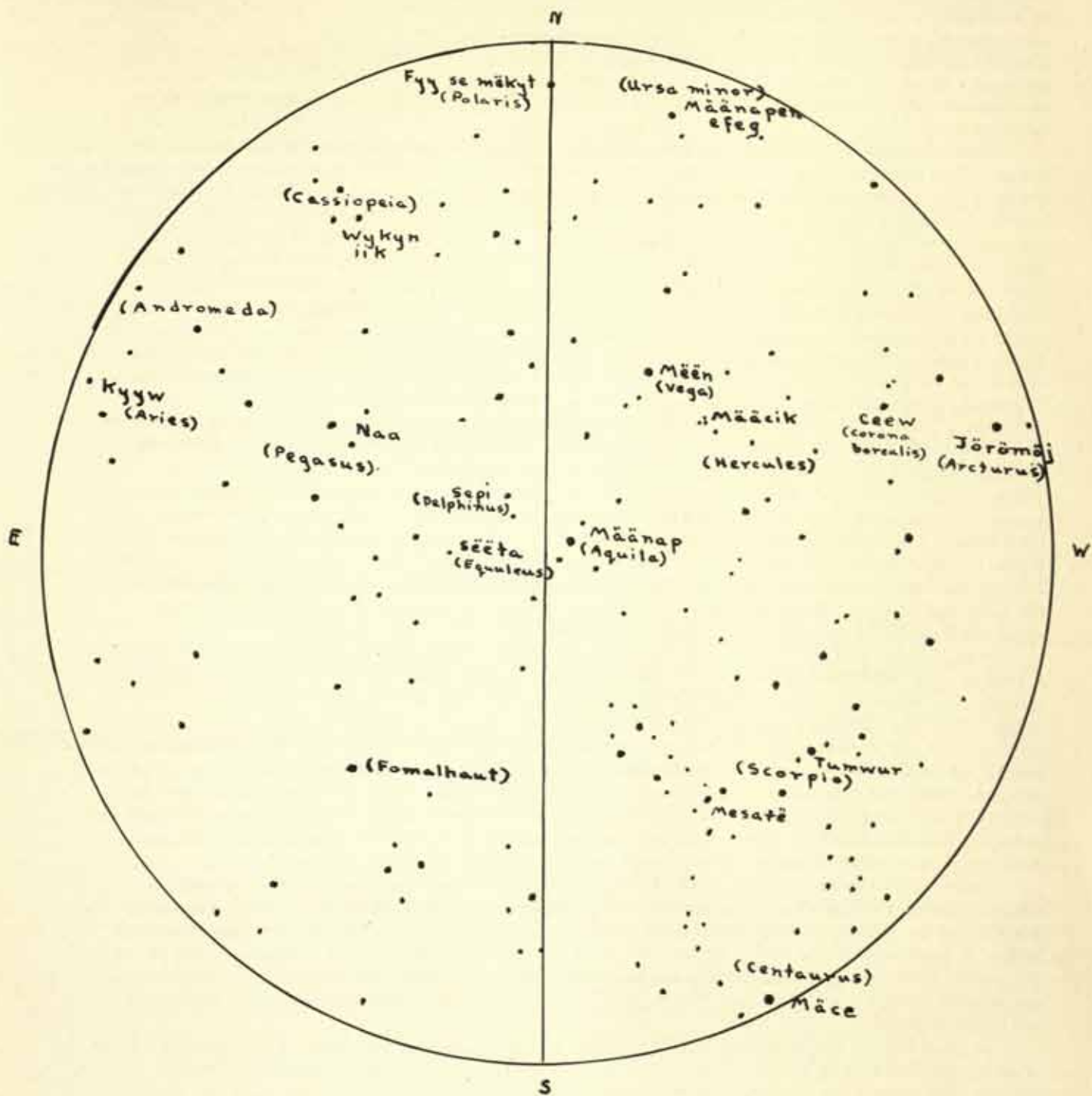


Figure 5. Map of the Stars as Seen from the Central Carolines, 8 Hours at the Meridian.

than would inevitably result from the use of constellations convenient for calendrical purposes.

Since the sidereal months vary both in number and length, they cannot be equated with the native lunar months of thirty-day duration. It is genuinely puzzling, therefore, that the natives should refer to their sidereal months as *maram* (moons), the same name used for lunar months. This usage cannot be attributed to European influence, for it is standard throughout the Central Carolines regardless of differences in degree of acculturation. We must conclude, therefore, that originally native time-reckoning followed a lunar calendar and that the sidereal calendar developed from it as a more precise means of measurement which for practical purposes was dissociated from the lunar month, though continuing to carry its name.

This may have developed through a partial fusion of the lunar calendar with an older sidereal almanac, as is suggested by Krämer's (1937: 135-7) data from Lamotrek. While he reports a formal calendar of twelve months, he also presents a set of eighteen stars commonly used by navigators. They must have had a temporal significance for his informants, for he gives them in order of their right ascensions and correlates the native names for prevailing winds with the times of their heliacal risings (in a few instances their settings). This list of eighteen stars corresponds very closely with the twenty from which all month names in the various local calendars are selected. The shorter sidereal calendars, then, would appear to be abridgments of a longer navigator's almanac.¹ The abridging process may be interpreted as an attempt to bring the sidereal divisions of the year into closer agreement with the lunar calendar, a process which the practical requirements of navigation would tend to inhibit. Thus, the Puluwatese, who according to Damm and Sarfert (1935: 86) are famed as the most skilled navigators in the Carolines, have not abridged their almanac beyond fourteen months.

On only one island, tiny Ngulu, is there good evidence of a reasonably complete rapprochement between the lunar and sidereal calendars (Eilers, 1935-6, ii: 240). The people of Ngulu have borrowed Central Carolinian astronomy from their neighbors, but are themselves Yapese in speech. On Yap (Müller, 1917: 282-3), the native calendar divides the year into twelve or thirteen lunar months, whose names are different from those in the Central Carolines Language Area. Using the calendar typical of their Central Carolinian neighbors, the navigators of Ngulu have adapted it to the Yapese system. They divide the year into twelve lunar months, with a thirteenth for "leap" years, but name them for constellations following the sidereal calendar. Keeping the sidereal calendar as well, they have learned how the lunar and sidereal months of similar name change in their relationship to one another and about every third year, use the extra lunar month to bring the two calendars back in phase.

It is possible that the vaguer associations in the central Carolines proper reflect the beginning of a similar trend stimulated by the Yapese lunar calendar, for Yap, while not one of the Central Caroline islands, has exerted great political and cultural influence over them in recent centuries (Lessa, 1950a). In any event, the sidereal calendar of the Central Carolines cannot be viewed as some dimly remembered heritage from the ancient orient. It must be seen as a local creation resulting from the astronomical observations required for navigation. These observations produced an almanac which was then abridged to bring the number of sidereal divisions closer to the number of lunar months in a year. In this way the sidereal months came to be called "moons." It would appear that a rapprochement between the lunar and sidereal calendars is still in process (except as terminated by acculturation), integration having been achieved, if available evidence can be trusted, only on the marginal atoll of Ngulu.

Native astronomers are aware of the year in a solar as well as a sidereal sense. On Sonsorol (Eilers, 1935-6, i: 89) the year is named for Altair, whose rising indicates due east. When the sun's position on the ecliptic is such that it rises in the compass position of Altair, the new year is said to begin. It continues to rise further to the north until it comes up in the compass position marked by the Pleiades. It then swings south until it rises in the position of Antares, whence it returns to Altair for the start of another year. Thus the "Altair year" is a solar one beginning with the native equivalent of our vernal equinox.²

In other islands navigators use a sidereal year whose beginning coincides with the heliacal risings of either the Pleiades or Antares (which incidentally correspond roughly to our summer and winter solstices). Throughout the islands, however, native observers have noted that the sun rises and sets further to the north or south in relation to its background of stars, and that one complete cycle of this

¹The apparent existence of a similar almanac in the Gilbert Islands lends weight to this interpretation. See Grimble (1924: 127).

²Eilers says that the month in which the sun rises in Altair on Sonsorol is *tumugi* (Antares), whose heliacal rising is December-January. This contradiction may be resolved if the Sonsorolese keep both a lunar and sidereal calendar each with the same month names, as on Ngulu. Otherwise, the sidereal months on Sonsorol must begin at other than the heliacal risings of the constellations for which they are named. Cf. the rather different solar year in the Gilberts (Grimble, 1931).

sort corresponds to the annual revolution of the skies.¹ Since their points of reference are abstractions based on the directions in which stars rise and set rather than the stars themselves, they have not developed a true zodiac of the ancient Near Eastern type in whose twelve constellations the sun was actually seen to rise.

We may now list and discuss the twenty stars and constellations for which the sidereal months are named in the several calendars.

1. *tumwur* (Antares), see compass position 13 above.

2. **māācīk*, which means the "little *maa*" as distinct from *māānap* (Altair), the "main *maa*." Its distribution appears as follows:

2. *meezyk* (ν , ξ , θ Herculis), 10a. *mailiik* (Lyra), 11. *mairig*, 12. *mei rik*, 13a. *maidjik* (shown on map as west of Altair and south of Vega), 13b. *mairig*, 14. *meiirūx*, 16. *maidjik*, 18. *maidjuk*, 19b. *maitsig*, 21a. *maidzix*, 21b. *maitsig*, 22. *māsisik*, *māθisik*, 23. *māθirik*, 24. *māθisik*, 25. *māsisik*.

Kubary's identification for the Mortlocks (2) seems appropriate to this constellation's position in the calendar. The identification with Lyra on Satawal (10a) conflicts with that of *mēēn* which appears in Satawal's compass. Both *māācīk* and *mēēn* appear in calendars, but never in the same one. They are not the same constellation, however, because *mēēn* is reported from all the islands on which *māācīk* is found. They are distinct, but close enough in the sky to provide alternate names for the same month. The cognate of *māācīk* appears in Gilbertese astronomy as *matiriki*, where it is identified with Rigel (Grimble, 1924: 135).

3. *mēēn* (Vega), see compass position 5 above.

4. *māānap* (Altair), see compass position 9 above.

5. *sēēta*, which appears to be associated with Equuleus. The distributional evidence is as follows:

1a. *sēēta*, 1b. *sōta*, 1c. *soeda*, 1d. *soda*, 2. *soota* (α Equulei), 3. *soata* (Delphinus), 4. *soda*, 5. *seota*, 7. *fōta*, 9. *hōōda* (Corona), 10a. *sōōda* (Corona), 10b. *seuta* (Corona), 11a. *seota* (in Pegasus), 11b. *seuta*, 12. *zaata*, 13a. *sooda*, *ooda* (shown on star map as consisting of two parts in the vicinity of Equuleus or Aquarius and Pegasus), 13b. *sotaa*, 14. *θada*, 16. *sooda*, 17. *sooda* (Equuleus), 18. *toθē*, 19b. *tōθaa*, 21a. *θōθōx*, 21b. *tōdaa*, 21c. *θāθāx*, 22. *tauta*, 23. *tauta*, 24. *tauta*, 25. *tauta*.

From the above evidence it appears best to identify *sēēta* with Equuleus, for its position on the calendar obviates Corona as a possibility. Delphinus is called *sepi* (bowl) in the Carolines. It may be a part of *sēēta*, however, for Christian (1889: 390) records *sepei-ping-en-Sota*, "the bowl in the midst of Sota," as Delphinus and Cygnus, and Kubary (1880: 288-9) records *piingen soota* as α , γ , ν , ξ Cygni in the Mortlocks (2). The meaning of the name *sēēta* is obscure. Related forms appear in the Marshalls (Krāmer and Nevermann, 1938: 219, and Erdland, 1914: 79) as *tidada* or *jedaada* (γ , ζ , π Aquarii),² and on Nukuoro (Eilers, 1934: 299) as *seta*.³

6. *naa*, a constellation closely associated with *sēēta*, and apparently situated in Pegasus.

1a. *naa*, 1b. *na*, 1c. *na*, 1d. *na*, 2. *laa* (α Andromedae and β , η , μ Pegasi), 3. *la* (Pegasus, "eel"), 4. *laa*, 5. *la*, 7. *la*, 9. *la*, 10a. *laake*, 11a. *lag* (α Pegasi), 11b. *lakh*, 12. *lax*, 13a. *laake*, *laaxe* (in position of Pegasus on star map), 13b. *lag*, 14. *nax*, 16.

¹Girschner (1912: 173) quotes a navigator from Namoluk, for example, as follows: "I am well aware of the foreigner's claim that the earth moves and the sun stands still, as someone once told us; but this we cannot believe, for how else could it happen that in the morning and evening the sun burns less hot than in the day? It must be because it has been cooled when it emerges from the water and towards setting again approaches the water. And furthermore, how can it be possible that the sun remains still when we are yet able to observe that in the course of the year it changes its position in relation to the stars?"

²The second element of the name is doubled here. Its Trukese equivalent would be **sēētaata*.

³Such Polynesian constellations as *taaha* or *kauha* are not cognates of *sēēta*, although on Nukumanu and Ontong Java they are identified with the great square of Pegasus (Sarfert and Damm, 1929: 187-195). The Polynesian names mean "four stars;" whatever *sēēta* means, it isn't that.

naake, 17. laake (Pegasus), 18. laag, 19b. laax, 21a. laax, 21b. laag, 22. raaxe, 23. naaxe, 24. naxe, 25. raag.

The identification with stars in Pegasus is corroborated by information from the Marshalls, where Erdland (1914: 79) reports the constellation *lak* as composed of Beta, Mu, and Lambda Pegasi. The corresponding month name, *oraaka*, from Nukuoro (Eilers, 1934: 299) is probably a loan word from a central Carolinian dialect. There are two unidentified stars reported from the Gilbert Islands, *nakatei* and *naatirea*, the first element of one of which may be a cognate of *naa* (Grimble, 1924: 136). Connected with *naa* is a star or constellation called **jepin naa* or **jepinaa*, "end of *naa*," reported from Lamotrek (11b) as *gapi lah* (in Pegasus) and from Elato (12) as *gapi laax* (α Arietis). From Lamotrek (11b) is also reported a *ping-en-lakh* (in Aries, "the center of the house"). While the latter is known from nowhere else, the former has its counterpart in the Marshallese *kabiilak* (α, β, δ Persei) according to Erdland (1914: 80). The meaning of the name *naa* is obscure, the only suggestions being Girschner's translation as "eel" for Namoluk (3) and Christian's as "house" for Lamotrek (11b).

7. *kyyw*, "porpoise," which appears to include parts of Andromeda, Aries, and Pisces.

1a. *kyyw* ("porpoise"), 1b. *kū*, 1c. *gu*, 1d. *ku*, 2. *kū* (Aries), 3. *kuu* (Aries, "dolphin"), 4. *ku*, 5. *gu*, 7. *ku*, 9. *gūū*, 10a. *guu*, 11a. *gui*, 11b. *ku*, 12. *kui* (Pisces, "whale"), 13a. *guu*, *gui* ("fish," said to be a large constellation including Orion and Corvus, but represented on star map as having its tail in Cassiopeia and running due south therefrom in Andromeda, Aries, and Pisces), 13b. *gu(a)*, 14. *xue*, 15. *guui*, 16. *guui*, 17. *gui* (Delphinus), 18. *gui*, 19b. *guui*, 20a. *guuii* ("dolphin," includes *uugenig*, Cassiopeia, *laag*, and four unidentified "dark stars" named *tšaapelevoov*, possibly in Pisces or Cetus), 21a. *uui*, 21b. *guui*, 22. *guui*, 23. *gui*, 25. *xux*.

This constellation has its counterpart in the unidentified Gilbertese *kuua*, "porpoises" (Grimble, 1924: 135), and in the Marshallese *lageege*, "porpoise," which, according to Erdland (1914: 86-7), consists of Alpha, Beta, and Gamma Arietis as the head (*elemung*), Beta Andromedae as the dorsal fin (*ūl*), Gamma Andromedae as the belly-fin (*bob*), and Cassiopeia as the tail (*lok in lageege*). It will be recalled that in the central Carolines *wykyn iik* is the name for Cassiopeia and means "tail of the fish." Indeed, *jiik* (fish) appears as a possible variant name for *kyyw*. It is given as a constellation in Pisces by Christian for Lamotrek (11b). "The Fish" appears as a Polynesian designation for the Milky Way (Makemson, 1941: 185-7), but should not be so identified in the Carolines, where the name for the Milky Way is *jaan* (path) or **jaanenimej* (path of the breadfruit) in reference to the belief that breadfruit comes each season from the mythical homeland of *jēwyr* in the south. We may tentatively accept Erdland's identification for *lageege* in the Marshalls as the proper identification of *kyyw* in the Carolines, one which accords perfectly with its place in the calendar.

8. *jenimatē*, an unidentified constellation between *kyyw* and the Pleiades. The distributional evidence is as follows:

1a. *jenimatē*, 1c. *ennimata*, 1d. *elimada*, 3. *anumatō*, 7. *enimata*, 9. *ānimādo*, 10a. *ānimādo*, 11a. *ālimeto* ("fish's belly"), 13a. *ālimedau*, 15. *alimeto*.

The place of this star in the calendar puts its rising after that of *kyyw* and before that of *mweriker* (Pleiades). Its description on Lamotrek (11a) as the "fish's belly" would cause us to identify it with Gamma Andromedae, following the Marshallese analogy used above in identifying *kyyw*. The appearance of *jenimatē* in only a few calendars suggests that it is not important in temporal discriminations and may well, therefore, be part of a constellation already included in the calendar.

9. *mweriker* (Pleiades), see above under compass position 6.

10. *wuun* (Aldebaran Tauri), see above under compass position 7.

11. *jēnywēn* (Orion's belt), see above under compass position 11.

12. *maan*, a large constellation including Procyon and Sirius and meaning "animal" or "bird," most probably the latter.

1a. maan, 1b. man, 1c. man, 2. maan (Sirius), poun maan (Procyon, "arm of maan"), 3. man (Sirius), 4. maan, 5. man, 7. maan, 9. maan (Procyon), 10a. mää, (Procyon), 10b. mall (Procyon),¹ 11a. mal, 11b. man, mal (Canis major), kolong-al-mal (Sirius, "the body of the animal"), 12. mall, maal, golongeli maal (Sirius, "heart of the bird"), 13a. määlu, 13b. mal, 14. malüü, mal, 15. mal, 16. mäl, 17. maal, (Procyon), 18. maal, 19b. mal, 20a. man ("bird," consisting of *poneman nuu iimutš*, "southern wing," equated with Canopus; *poneman nuu eeluutš*, "northern wing," equated with Castor and Pollux; *man*, the body, equated with Procyon; and *golong*, "the heart," equated with Sirius), 21a. maam, moon, 21b. man, 22. maar, 23. maar, 24. maari, 25. maar.

The name *maan* is commonly applied to constellations in other parts of the Pacific. As *manu* it is associated with other constellations in Polynesia proper (Makemson, 1941: 229). Sirius is called *man* on Kapingamarangi, and *manu* appears as a month name on Nukuoro (Eilers, 1934: 143, 299). Canis major is called *manuai* by the Melanesian Manus (Parkinson, 1907: 377-8). Interestingly, the name is not reported for a constellation in the Marshalls, where Erdland (1914: 78) specifically states that there is no native name for Sirius, but it occurs in the Gilbert Islands, where Sirius is called *baba ni man* (Grimble, 1924: 135). The many confusions in the sources between *maan* and *mään* (Lyra) have already been discussed in connection with compass position 5.

13. *jiic*, a constellation in Leo. The distributional evidence is as follows:

2. iiz (α , γ , η , ξ Leonis), 3. ii θ (Regulus), 10a. idj, 11a. idj (cloud in Leo setting 1-15 July), 12. itš, itj, 13a. iidj, 13b. itr, 14. i θ , 16. it, 17. iit, 18. idj, 19b. iitš, 21a. idž, 21b. yiitš, 21c. idž, 22. iis, 23. iis, 24. iis, 25. jiits.

In doubled form the name appears in the corresponding month position of the Nukuoran calendar as *ititi* or *idit* (Eilers, 1934: 299) and may even be reflected in the Marquesan *iti* (Makemson, 1941: 213). We must tentatively accept Kubary's identification for the Mortlocks (2), corroborated by Girschner for Lukunor (3), as the correct one for the central Carolines. Christian (1899: 390) gives the meaning of the name as "rat."

14. **jōnumas*, a constellation in Crater and so far reported only for the easternmost atolls of the Central Carolines Language Area.

1b. ōnumas, 2. eonmas (α , β , δ , θ Crateris), 3. eaunema θ (Crater).

15. **jinnenikak*, a constellation or star of obscure identity, but probably Nu, Pi, Omicron Virginis.

2. iinnelikak (ν , π , \omicron Virginis), 11a. ililigäk (Regulus), 11b. ililigak (Regulus), 21a. iligequux, 21b. iilääliigääg.

16. **pwuupw* (Crux), see above under compass position 15.

17. **serepwēn* (Corvus), see above under compass position 12.

18. *jääp*, a name which means "tail," or "end," and which apparently designates stars in several constellations. In the calendar it is to be equated with Spica (α Virginis).

1a. jääp, 1b. äp, 2. aapin soropuel (tail of Corvus), 7. eeb, 9. ääb, 11a. gaap (following a little less than a month after *naa*, gap i eaur (Canopus), 11b. gapi sarabol (Speaker, sic), 12. gapi eaur (Canopus), gapi θ areuol (Spica), gapi laax (α Arietis), gapi tuuo (Fomalhaut), 15. gaap (Spica).

Of the various stars which might be called *jääp*, (Spica, Canopus, Alpha Arietis, and Fomalhaut) it is the first named whose right ascension fits the place of the month *jääp* in the sidereal calendar. The name, therefore, appears to be a short form of the longer **jepin serepwēn* or **jepiserepwēn* (tail of **serepwēn* or **serepwēn*-tail).²

¹Touloulou (**tuluulu* ?) is given as the name for Sirius in 10b.

²Cf. our discussion of compass position 13 above.

19. *jōromōj*, which is clearly to be identified with Arcturus (α Bootis). The distributional evidence is as follows:

1a. *jōromon*, *jōromōj*, 1b. *aromōi*, 1c. *aromoi*, 1d. *oromai*, 2. *aramoy* (Arcturus), 3. *aaromoi* (Arcturus), 4. *aremois*, 5. *aramoe*, 7. *aremoz*, 10a. *āremaus* (Arcturus), 10b. *aromoi* (Arcturus), 11a. *aremaus*, *aremoi*, (Arcturus), 11b. *aramoi*, *aramaus* (Arcturus), 12. *aremauz*, 13a. *elemaudj*, 13b. *aramaus*, 14. *eremaui*, 15. *eramoi* (Arcturus), 16. *eremaiis*, 17. *eremoi*, 18. *eremaus*, 19b. *yeromos*, 21a. *ārāmoi*, 21b. *yeremoui*, 21c. *eremoi*, 22. *eglemauθ*, 23. *elemauθ*, 24. *eglamaut*.

Eilers (1934: 143, 299) reports the same name for Nukuoro as *ramoi* or *aramoi* and possibly for Kapangamarangi as *lomoi* or *namoi*. The identification is clear and fits the position in the calendar occupied by the month of this name.

20. *ceew*, which means "net" and is probably to be identified with Corona borealis.

1a. *ceew*, 1b. *cheū*, 1c. *djēū*, 1d. *tēu*, 2. *žeu* (Corona borealis), 3. *θou*, 4. *teeu*, 5. *djau*, 7. *reu*, 9. *djoou* (Arcturus), 11a. *djou* (Corona), 11b. *tchrou* (Corona, "fowling net").

The identification with Arcturus on Puluwat (9) is probably due to confusion with *jōromōj*, which provides the name for the corresponding month in the calendar of Satawal (10a), for Damm and Sarfert (1935: 273) report both calendars together.

Having to the best of our ability identified each of the stars and constellations used, we may now consider the actual calendars employed in the Central Carolines. Table 2 presents them so that they may readily be compared.

Comparison shows that from the standpoint of their calendars, the islands in the Central Carolines Language Area fall into two distinct groups: a western one from Lamotrek through Tobi in which identical calendars appear,¹ and an eastern one from Satawal through the Mortlocks in which calendars vary. Of these, the Mortlockese calendar is most like those in the west from which it differs only with the addition of *mweriker* as a month and the compensatory combination of *wuun* and *jēnywēn* into a single month of "hyphenated" name. Except that some Polynesian names have been substituted for their Carolinian equivalents, the calendar of Nukuoro corresponds exactly with that of the Mortlocks, clearly the source from which it has been derived. It is on Truk and the atolls in its immediate vicinity that the greatest variations appear.

In this regard two things are worthy of note. First is the fact that the Trukese gave up long distance voyaging about a century and a half ago (Krämer, 1932: 300). Knowledge of navigation consequently waned. The few Trukese who acquired this skill in recent times learned it from Mortlockese or Puluwatese navigators. This would account for the greater variation in calendars reported from Truk. The second point has to do with differences in schools of navigation, to which we have already referred above. It appears that a single school of navigation prevails in the western islands, whereas the existence of at least two schools, *Werijeg* and *Fāānuuc*, each with a different calendar, helps explain the variations in the west.

None of these differences, however, are such as to obscure the basic similarity of all of the central Carolinian calendars. They are but minor variations in a single over-all system.

¹Sorol is a possible exception. While Tobi is reported with a calendar of ten months, all ten correspond exactly with the months in the calendars of other western islands. It seems reasonable to assume that the remaining two are missing due to an oversight.

TABLE 2

Comparison of Central Carolinian Calendars

| <i>Month Name</i> | <i>Identification</i> | <i>Right Ascension</i> | <i>Truk (1a)</i> |
|-------------------|-----------------------------------|----------------------------|-------------------------------|
| 1. tumwur | α Scorpii (Antares) | 16:25 | 1. tumwur |
| 2. *māācik | ν, ξ, θ Herculis | 18:00 | . . . |
| 3. mēēn | α Lyrae (Vega) | 18:35 | 2. mēēn |
| 4. māānap | α Aquilae (Altair) | 19:50 | 3. māānap |
| 5. sēēta | α Equulei | 20:35 | 4. sēēta |
| 6. naa | β Pegasi | 23:00 | 5. naa |
| 7. kyyw | β Andromedae | 1:05 | 6. kyyw |
| 8. jenimatē | γ Andromedae | 2:00 | 7. jenimatē |
| 9. mweriker | η Tauri (Pleiades) | 3:45 | 9. mweriker |
| 10. wuun | α Tauri (Aldebaran) | 4:40 | 8. wuun |
| 11. jēnywēn | δ, ϵ, ζ Orionis | 5:35 | . . . |
| 12. maan | Sirius and Procyon | 6:45 | . . . |
| 13. *jiic | α Leonis (Regulus) | 8:40 | . . . |
| 14. *jōnumas | Crater | 11:00 | . . . |
| 15. *jinnenikak | ν, π, θ Virginis | 11:50 | . . . |
| 16. *pwuupw | Crux | 12:20 | . . . |
| 17. *serepwēn | Corvus | 12:20 | . . . |
| 18. jāāp | α Virginis (Spica) | 13:25 | 10. jāāp |
| 19. jōromōj | α Bootis (Arcturus) | 14:15 | 11. jōromōj |
| 20. ceew | Corona borealis | 15:30 | 12. tumwur kaaka ¹ |

¹The name appears in no other calendar nor anywhere else as a star or constellation. Its position in the calendar makes it the equivalent of *ceew*.

(Table 2, continued)

| <i>Truk</i> (1d) | <i>Truk</i> (1c) | <i>Truk</i> (1b) | <i>Mortlocks</i> (2) |
|-------------------------|------------------|------------------|----------------------|
| 1. pumur | 1. tumur | 1. tumur | 1. tuumur |
| . . . | . . . | . . . | 2. meeyžik |
| 2. mōn, man | 3. mōn | 2. mōn | . . . |
| 3. mālap | 2. meilap | 3. meinap | 3. meeylap |
| 4. soda | 4. soeda | 4. sōta | 4. soota |
| 5. na | 5. na | 6. na | 5. laa |
| 6. ku | 7. gu, ku | 5. kū | 6. kū |
| 8. elimada | 8. ennimata | . . . | . . . |
| 9. mōrgōr | 9. moerriger | 7. mweriker | 7. meeriker |
| 7. un | 10. un | 8. un | 8. uun-eelluel |
| . . . | 11. alual | . . . | (uun-eelluel) |
| . . . | 12. man | 9. man | 9. maan |
| . . . | . . . | . . . | 10. iiž |
| . . . | . . . | 11. ōnumas | . . . |
| . . . | . . . | . . . | . . . |
| . . . | . . . | . . . | . . . |
| . . . | 13. sarovol | 10. serepwēn | 11. soropuel |
| 10. elidau ¹ | . . . | 12. āp | . . . |
| 11. oromai | 14. aromoi | 13. aromoi | 12. aramoy |
| 12. tēu | 6. djēū | 14. cheū | . . . |

¹This name appears nowhere else. It is here equated with *jōāp* only because its position in the calendar permits it and Bollig's and the writer's calendars are otherwise so much alike.

| <i>Namoluk</i> (3) | <i>Nama</i> (4) | <i>Murilo</i> (3) | <i>Namonuito</i> (7) | <i>Puluwat</i> (9) |
|--------------------|-----------------|-------------------|----------------------|--------------------|
| 1. tumwur | 1. tumur | 1. tumur | 1. tumur | 1. tumur |
| . . . | . . . | . . . | . . . | . . . |
| 2. moal | 2. mol | 2. mēēl | 2. möl, meilap | 2. mool |
| 3. meilap | 3. mai lob | 3. mailap | (möl, meilap) | 3. mailöb |
| 4. soata | 4. soda | 4. seota | 3. föta | 4. hōōda |
| 5. la | 5. laa | 5. la | 4. la | 5. la |
| 6. kuu | 6. ku | 6. gu | 5. ku | 6. kүү |
| 7. anumato | . . . | . . . | 6. enimata | 7. ānimādo |
| 8. mweriker | 7. maarigu | 7. maragar | . . . | 8. mariger |
| 9. uun | 8. un | 8. uun | 7. uoun | 9. uun |
| . . . | . . . | . . . | 8. öliöl | 10. elüüel |
| 10. maan | 9. maan | 9. man | 9. maan | 11. maan |
| 11. iiθ | . . . | . . . | . . . | . . . |
| 12. eaunemaθ | . . . | . . . | . . . | . . . |
| . . . | . . . | . . . | . . . | . . . |
| . . . | . . . | . . . | 10. pub | 12. buub |
| 13. saropwil | 10. serebol | 10. sarepol | . . . | . . . |
| . . . | . . . | . . . | 11. eeb | 13. āāb |
| 14. aaromoi | 11. aremoi | 12. aramoe | 12. aremouz | . . . |
| 15. θou | 12. teeu | 11. djau | 13. reu | 14. djoou |

(Table 2, continued)

| <i>Satawal</i> (10a) | <i>Lamotrek</i> (11a) | <i>Lamotrek</i> (11b) | <i>Elato</i> (12) | <i>Ifalik</i> (13a) |
|----------------------|-----------------------|-----------------------|-------------------|---------------------|
| 1. tumul | 1. tumur | 1. tumur | 1. tumul | 1. dumul |
| 2. mailiik | 2. mairig | 2. mai-rik | 2. mai i rik | 2. maidjik |
| . . . | . . . | . . . | . . . | . . . |
| 3. mailöb | 3. mailap | 3. mai-lap | 3. mai i lap | 3. mailöb |
| 4. sööda | 4. seota | 4. seuta | 4. θaata, θauθa | 4. sooda, ooda |
| 5. laake | 5. lag | 5. lakh | 5. lax | 5. laake |
| 6. guu | 6. gui | 6. ku | 6. küi | 6. guu, guui |
| 7. änimädo | . . . | . . . | . . . | . . . |
| 8. mariger | . . . | . . . | . . . | . . . |
| 9. uul | 7. ul | 7. ul | 7. ul | 7. uul |
| 10. elüüel | 8. eliöl | 8. alliel | 8. üliül | 8. elüöl, erüöl |
| 11. määäl | 9. maal | 9. man | 9. mall, maal | 9. määlu |
| 12. idj | 10. idj | 10. ich | 10. itš, itj | 10. iidj |
| . . . | . . . | . . . | . . . | . . . |
| . . . | . . . | . . . | . . . | . . . |
| . . . | . . . | . . . | . . . | . . . |
| 13. selewol | 11. sarepol | 11. sarabol | 11. θare uol | 11. djelewol |
| . . . | . . . | . . . | . . . | . . . |
| 14. äremaus | 12. aremaus, -oi | 12. aramaus | 12. aremauθ | 12. elemaudj |
| . . . | . . . | . . . | . . . | . . . |

| <i>Ifalik</i> (13b) ¹ | <i>Faraulep</i> (14) | <i>Eauripik</i> (16) | <i>Sorol</i> (17) ² | <i>Fais</i> (18) |
|----------------------------------|----------------------|----------------------|--------------------------------|------------------|
| 1. fale tumur | 1. tumulū | 1. dumul | 1. dumul | 1. θumur |
| 6. fale mairig | 2. maiirūx | 2. maidjik | . . . | 2. maidjuk |
| . . . | . . . | . . . | 6. mool | . . . |
| 7. fale mailap | 3. mailöp | 3. mailöb | 10. mailöb | 3. mailap |
| 5. fale sotaa | 4. θada | 4. sooda | 3. sooda | 4. toθē |
| 10. fan nag | 5. nax | 5. naake | 7. laake | 5. laag |
| 12. fale gua | 6. xue | 6. guui | 8. gui | 6. gui |
| . . . | . . . | . . . | . . . | . . . |
| . . . | . . . | . . . | 9. maaleg | . . . |
| 9. fal uul | 7. uuul | 7. uul | . . . | 7. uul |
| 8. falū eliel | 8. ūliūl | 8. elūüel | 11. elūüel | 8. iēliol, eliol |
| 11. fale mal | 9. malūū | 9. mālāl | 2. maal | 9. maal |
| 4. fal itr | 10. iθ | 10. it | 5. iit | 10. idj |
| . . . | . . . | . . . | . . . | . . . |
| . . . | . . . | . . . | . . . | . . . |
| . . . | . . . | . . . | . . . | . . . |
| 3. fale sarabwolu | 11. θarebol | 11. serewol | 12. serewol | 11. seravol |
| . . . | . . . | . . . | . . . | . . . |
| 2. fal aramaus | 12. eremaui | 12. eremaiis | 4. eremoi | 12. eramaus |
| . . . | . . . | . . . | . . . | . . . |

¹This calendar is highly aberrant in the order of months, suggesting that Burrows' informants were not too well acquainted with the old system of reckoning time. In his notes Burrows points out that there were other inconsistencies in their information and that the calendar as reported was arbitrarily ruled on by the high chief where points of disagreement arose. The term *fale* is said here to mean "house," the heavens being divided into a series of houses, each of them named for a constellation or star. This is the only instance where such a conceptualization of the skies, so characteristic of ancient Near-Eastern and Hindu astronomy, is reported for the Carolines. Could the expression be related to the Trukese *fāā-n*, *fāā-ni*, meaning "under," "below"?

²The people of Sorol had forgotten their calendar except for the names employed in it (Damm, 1938: 250).

(Table 2, continued)

| <i>Ulithi</i> (19b) | <i>Ngulu</i> (21a) | <i>Ngulu</i> (21b) | <i>Ngulu</i> (21c) | <i>Sonsorol</i> (22) |
|---------------------|----------------------------|------------------------------|--------------------|----------------------|
| 1. θuumur | 1. θuumur | 1. duumur | 1. θuumuur | 1. tumugl |
| 2. maitšig | 2. maidžix | 2. maitšig | . . . | 2. māsisik |
| . . . | . . . | . . . | . . . | . . . |
| 3. mailap | 3. mailap, θoθox | 3. mailap | . . . | 3. māθitōp |
| 4. toθaa | (θoθox) | 4. toodaa | 2. θāθāx | 4. tauta |
| 5. laax | 4. laax | 5. laag | . . . | 5. raaxe |
| 6. guui | 5. uui | 6. guui | . . . | 6. guui |
| . . . | . . . | . . . | . . . | . . . |
| . . . | . . . | . . . | . . . | . . . |
| 7. wul | 6. uun | 7. wun | . . . | 7. uur |
| 8. eliiel | 7. eliel | 8. yeliiel | 3. ilul | 8. erūr |
| 9. mal | 8. maam, moon | 9. man | . . . | 9. maar |
| 10. iitš | 9. idž | 10. yiitš | 4. idž | 10. iis |
| . . . | . . . | . . . | . . . | . . . |
| . . . | 10. iligeguux ¹ | 11. iläaliigääg ¹ | . . . | . . . |
| . . . | . . . | . . . | . . . | . . . |
| 11. saravul | 11. θarewol | 12. sarovol | 5. θerewol | 11. talowor |
| . . . | . . . | . . . | . . . | . . . |
| 12. yeromos | 12. ārāmoi | 13. yeromoi | 6. eremoi | 12. eglemauθ |
| . . . | . . . | . . . | . . . | . . . |

¹This month occurs only in leap-years when a thirteenth month is added to bring lunar and sidereal cycles back in phase.

| <i>Pulo Anna</i> (23) | <i>Merir</i> (24) | <i>Tobi</i> (25) | <i>Nukuoro</i> ¹ | <i>Nukuoro</i> ⁶ |
|-----------------------|-------------------|------------------|-----------------------------|-----------------------------|
| 1. tuumul | 1. tuumugl | 1. tuumu | 1. tumuru | 1. tumuru |
| 2. māθirik | 2. maθisik | 2. matsisik | 2. meitiki | 9. maitiki |
| . . . | . . . | . . . | . . . | . . . |
| 3. maθitōp | 3. māθitōp | 3. masirap | 3. meirapa | 10. mailapa |
| 4. tauta | 4. tauta | 4. tauta | 4. seta | 11. se ta |
| 5. naaxe | 5. naxe | 5. raag | 5. kaka ² | 12. oraaka |
| 6. gui | 6. gui | 6. xux | 6. tahora ³ | 2. tahola ³ |
| . . . | . . . | . . . | . . . | . . . |
| . . . | . . . | . . . | 7. matariki ⁴ | 4. matariki ⁴ |
| 7. uur | 7. uuru | 7. uur | . . . | . . . |
| 8. erūr | 8. jerūar | 8. ieriier | 8. takero ⁵ | 5. takero ⁵ |
| 9. maar | 9. maari | 9. maar | 9. manu | 6. manu |
| 10. iis | 10. iis | 10. iits | 10. idit | 7. ititi |
| . . . | . . . | . . . | . . . | . . . |
| . . . | . . . | . . . | . . . | . . . |
| . . . | . . . | . . . | . . . | . . . |
| 11. talawor | 11. taiglowor | . . . | 11. sarapori | 8. sarapoli |
| . . . | . . . | . . . | . . . | . . . |
| 12. elemazu | 12. eglamaut | . . . | 12. aramoī | 3. ramoī |
| . . . | . . . | . . . | . . . | . . . |

¹As recorded by Jeschke (Eilers, 1934: 299).

²A corruption of **raaka* (?).

³A clearly Polynesian name, though reported from nowhere else. It is here equated with *kyyw* because of its position in Jeschke's calendar.

⁴The common Polynesian name for the Pleiades corresponding to but not cognate with *mweriker*.

⁵A common Polynesian name for Orion's belt, the second element of which, *-kero* or *-kelo*, may be cognate with the root *jēny-* in the Carolinian *jēnywēn*.

⁶As recorded by Kubary (Eilers, 1934: 299).

THE PROBLEM OF ORIGINS

It was stated earlier that Central Carolinian astronomy appears to be in large part a local development rather than the result of diffusion from elsewhere. Having reviewed the evidence we are now in a position to outline the reasons leading to this conclusion.

Regarding the relations of Carolinian astronomy to that of Polynesia, Melanesia, and other parts of Micronesia, it is clear that these areas share few cognate names for stars. On Ponape and in the Marshalls we find the most cognates; they are fewer in the Gilbert Islands, and almost absent in Melanesia and Polynesia.¹ The writer has made no attempt to examine the Indonesian material in this regard, so the possibility of recent diffusion from the east remains open.

Carolinians resemble Polynesians and other Micronesians in that they use the stars for navigation purposes. Presumably their common ancestors did so, too. Moreover, they all share the custom of measuring time by the stars. None of the Polynesian calendars assembled by Makemson (1941: Appendix), however, show any closer resemblance to the Carolinian calendars than would necessarily follow from their being sidereal; and among the Polynesian calendars, themselves, there are wide differences.

We conclude, therefore, that when the ancestors of the present inhabitants of the Central Carolines first settled there, they brought with them a system of sailing directions and time measurement based on astronomical observations. This system was modified in time to meet the requirements of the area in which they now lived. Their nomenclature became so changed as to bear little resemblance to that of their remoter relatives. Sailing directions were organized into a genuine compass, and the almanac was reduced to a calendar by those Carolinians who lived on the small atolls and who had therefore to engage in trade in order to acquire necessary raw materials. Frequent contact between navigators from the different atolls helped keep the developing system of astronomy fairly uniform within the area.

The possibility of recent diffusion from Indonesia is the only objection which can be made to this interpretation. Internal evidence is not compatible, however, with this possibility. Such diffusion clearly did not come through Yap, which maintained the closest relations with the Central Carolines. It could have come only through the southwestern islands of Sonsorol, Pulo Anna, Merir, and Tobi. But it is precisely from these islands that linguistic evidence points to the greatest corruption of the Carolinian star-names as noted above in discussing *wykyñ iik*, *määnap*, and *jënywën*. Furthermore, their inhabitants derive themselves by their own traditions from Ulithi, not from the west (Eilers, 1935-6). Any diffusion from the west must have been early and coincident, or nearly so, with the appearance of the ancestors of the present Central Carolinian population. What they brought, as already stated, was in all probability different from the astronomy of their present day descendants, for the movements which populated the Carolines could not have been far removed from those which populated the Marshalls, and the astronomies of the Marshalls and the Carolines, while undoubtedly related, are clearly distinct.

¹Information on native astronomy in Melanesia appears to be very scanty. The fragmentary material reported by Parkinson (1907) for the Manus and by Ivens (1927) for Ulawa and Sa'a bears no resemblance to the Carolinian. For Polynesia we are fortunate in having Makemson's (1941) exhaustive catalogue of stars, and Grimble (1924: 135-6) has reported a list of sixty Gilbertese star names.

APPENDIX: MISCELLANEOUS STARS

Source materials for the central Carolines report a few star names which play no direct role in either the sidereal compass or calendar. We list them here in order to complete the existing record of Carolinian astronomy.

1. **sepi*, "bowl," which is probably to be identified with Alpha, Beta, Gamma, and Delta Delphini. As was noted in connection with the calendar, this constellation is closely associated with *sēēta* (Equuleus). Indeed, Christian (1899: 390), drawing on Kubary's notes for the Mortlocks records *sepei-ping-en-Sota*, "the bowl in the midst of Sota," as Delphinus and Cygnus. Erdland (1914: 79) reports the same constellation from the Marshalls as *jābi*, 'bowl' ($\alpha, \beta, \gamma, \delta$ Delphini). The four stars do indeed resemble the outline of a ceremonial wooden bowl as seen from above. Grimble (1924: 135) also reports "the bowl" as an unidentified constellation in the Gilbert Islands, though here it goes by a different name: *te kumete*. The distributional evidence in the Carolines is as follows:

2. *seepiy* ($\alpha, \beta, \gamma, \delta$ Delphini), 10b. *cheppi* (Cygnus, Delphinus), 11a. *tēbbi* (unidentified, but with the same right ascension as *seeta*, Equuleus), 13a. *dōbi* (in the position of Delphinus on star map).

2. **jefegen uun*, "north of *wuun* (Aldebaran)," apparently to be equated with Capella (α Aurigae). There is an entirely different name for Capella in the Marshalls, where it is called *ligedanger* (Erdland, 1914: 80, 83-4, 210-211) and is considered to be the mother of all the important stars, especially Antares and the Pleiades. There is a similar myth reported by Hambruch (1936) from Ponape explaining how the Pleiades gained the hegemony of the skies from Antares, but nothing of this sort is reported from the Central Carolines Language Area. The distributional evidence is as follows:

2. *eeffengen uun* (α, β Aurigae), 11a. *efang alul* (15 days after *ul*), 11b. *evang-el-ul* (Capella), 12. *iefangel uul* (Capella).

3. A star or constellation whose name I cannot reconstruct in Trukese, and which appears clearly to include Castor and Pollux (α, β Geminorum).

2. *maangan kitū* (α, β Geminorum), 11b. *mongoi-sap* (Gemini), 12. *monoi i zap* (Gemini, "fishhook-east").

4. *jaan* or **jaanenimej*, "path" or "path of the breadfruit," is the central Carolinian name for the Milky Way. It reflects the idea that the Milky Way is a great path from the south where the mythical homeland called *jēēwyr* is located. It is believed that this is the place whence come breadfruit and fish, and the Milky Way is the path which they follow.

1a. *jaan* (Milky Way), 12. *ealelimai* (Milky Way), 13a. *älalimeei* (Milky Way), but contrast with these 3. *wou* (Milky Way).

5. There remain a series of stars whose names are reported from only one atoll. Most of them are unidentified. They are listed below by locality.

Truk (1a) *cepeniky* (unidentified)
 cyyn meseniwēn (unidentified, "bones of the face of *wēn*")
 fyy rāān ("day star," 1b. *fū ran*, morning star; probably the same as 15.
 fusidjal, Venus in east).

- fyy se wewewen (unidentified, "star not straight," perhaps referring to the planets Mars and Jupiter?).
 jānewen mēgēr (Venus as evening star; lb. anoan mönger, Venus).
- Mortlocks (2) pešeeylam (unidentified)
 soroopuel en eeffeng (unidentified; in Trukese it would be called *serepwēnen efeg, "serepwēn of the north").
 ueeyang (β , δ , ν , σ , π , ω Scorpii)
- Namoluk (3) anuup (Cassiopeia, said to mean "it tips," which would be expressed as *jaa nuup in Trukese; this is very likely not a proper star name at all, but simply a descriptive statement of Cassiopeia's appearance at the time of observation, this constellation being recorded elsewhere as *wykyn iik*; see compass position 4)
 mejanii kārīk (β , δ Bootis).
- Lamotrek (11b) ngi-tau (Piscis australis)
- Ifalik (13a) moolarū (unidentified, but on star map appears near Lyra, *mēēn*, with which the name suggests a connection).
 niligu (unidentified, but on star map located in southern hemisphere; name possibly means "teeth of *kyyw*").
- Woleai (15) guar (Venus in west).

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¹Abbreviation: ESE, *Ergebnisse der Südsee-Expedition 1908-10* (Editor, G. Thilenius, Hamburgische Wissenschaftliche Stiftung und Notgemeinschaft der deutschen Wissenschaft, Hamburg, 1917-1938).

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