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Indigenous Calendar among Oceanic Seafarers

Akira GOTO*

The purpose of this paper is to discuss the prototype calendars of the voyagers who settled in the islands of Oceania. In particular, it reviews the indigenous calendars of western Melanesia in the area where the Lapita culture, the ancestors of contemporary Austronesian groups in Oceania, was distributed. Specifically, the paper examines calendars from the Schouten Islands and the Manus and Massim regions of northeastern New Guinea. These calendars are then compared to those of the western Micronesian islands of Kiribati and the Caroline Islands, which may have also been derived from the Lapita culture. As a result, the paper demonstrates the importance of celestial bodies, especially the Pleiades, to yam and breadfruit cultivation, as well as the importance of the Milky Way, relative to monsoon variation and navigation.

Key Words

Oceania, Austronesia, Calendar, Pleiades, Milky Way, Yam, Breadfruit

Contents

I Human Settlement of Oceanic Islands: From Near Oceania to Remote Oceania

Human migration into Oceania is divided into two stages. The first stage occurred during the late Pleistocene, the most recent ice age. The lowering of the sea level during the ice age connected the islands of Southeast Asia with the Eurasian Continent, resulting in the formation of Sundaland. Present-day Australia and the island of New Guinea formed a single land mass, which comprised the Sahul land mass. Between Sundaland and Sahul, there was the present-day Maluku Sea, which was not connected to land. The human groups that left Sundaland reached Sahul at least 50,000 years ago, with some estimates suggesting as much as 70,000 years ago (Bellwood and Hiscock 2018).

The second stage began about 5,000 years ago with the southward migration of Austronesian language groups who likely originated around Taiwan. They migrated from the Philippine archipelago through the islands of Indonesia, skirting the northern coast of New Guinea, which had already been inhabited since the

* Nanzan University

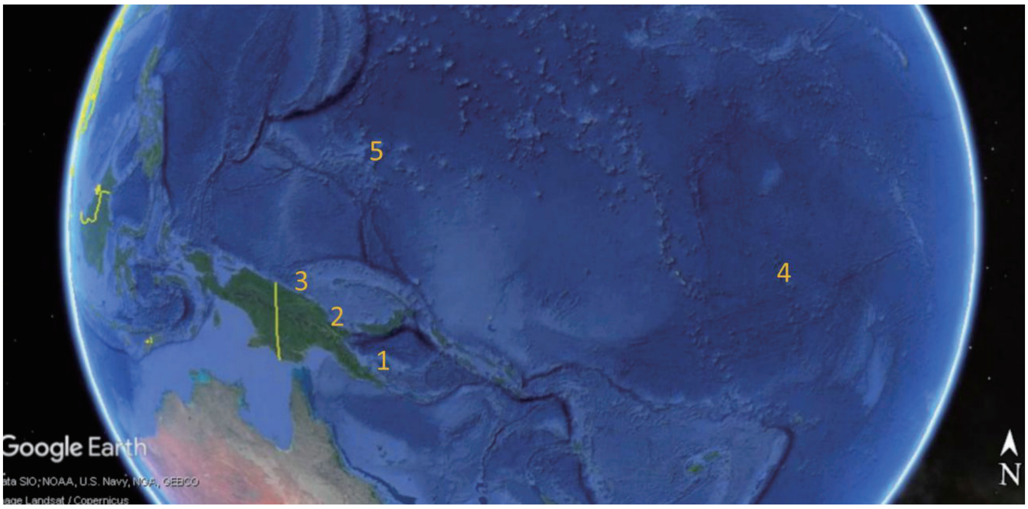


Fig. 1 Map of the Pacific and Areas Mentioned in this Paper

1: Massim, 2: Manus Island, 3: Schouten Islands,
4: Kiribati, 5: Chuuk Island

Palaeolithic period, and from the Bismarck Archipelago southeastward through the islands of present-day Melanesia. These were the first human groups who settled east of the Solomon Islands. This movement has come to be recognized as belonging to the Lapita culture because of their distinctive pottery. This population moved as far west as Tonga and Samoa roughly 3,000 years ago (Bellwood and Hiscock 2018).

This group, which had developed navigation technology, remained in this area for more than a thousand years, but the exact reason why is remains unknown (Anderson 2018). Some say that it took time to develop the navigation technology to travel to islands further away, and others say that they moved further east when El Nino occurred, for example, when the constant easterly winds (Anderson 2018). Although the exact reason remains unclear, the first Polynesians migrated from Central Polynesia, including from the island of Tahiti, to Hawai‘i in the north, Rapa Nui in the east, and New Zealand in the south some 1,200 to 900 years ago.

These Polynesians migrated from Central Polynesia to Rapa Nui eastward along the equator and from Hawai‘i and New Zealand longitudinally. One of the most interesting questions concerns why humans have traveled to these uncharted islands. While there is no definitive answer to this question, what is certain is that they did not migrate to islands rich in terms of flora and fauna, and that they brought with them crops and livestock of Southeast Asian origin. These two facts suggest that their migration was not a mere adventure or escape but a more deliberate one. They also must have possessed technologies for boat building and navigation to cross the vast ocean, and according to ethnographic data, one of the most important elements for navigation was astronomy. Their indigenous astronomical knowledge served as the basis for their calendar, which aided navigation.

In the following section, I will examine indigenous calendars from islands close to the Lapita homeland in order to consider the prototype of calendar among these Oceanic seafarers. Three examples come from Melanesia, from Massim, Manus and Wogeo of the Schouten Islands, and two come from Micronesia, Kiribati and the Caroline Islands (Fig. 1).

II Melanesia

1 Massim Area

The islands of the northeast coast of New Guinea practiced a famous exchange system called the Kula: in which two types of shell ornaments, necklaces and armbands, were exchanged in opposite directions between the islands distributed in a ring. Their main crop is yams, and the surplus of yams harvest is the basis of this ceremonial exchange (Austen 1939).

In the Trobriand Islands to the north of Kula Ring, yams are harvested around June with the heliacal rise of Pleiades, and then yam houses are filled with yams for

Fig. 2 Yam house filled with yams, Trobriands

demonstration (Fig. 2). This period corresponds to the beginning of Southeastern trade wind. During this time, a young girl's initiation ritual is performed, and this seasonal cycle and ritual are related to navigation and the building of voyaging canoes for the Kula exchange (Austen 1939). The preparations for ocean voyages were made in October and November, after new year, called Milamala. Then, in mid-December, the islanders sailed east or south from Trobriand on the northwest winds. The return journey happened from February to mid-April, when the weather calmed. Therefore, astronomical phenomena, crop cycles, wind shifts, annual ceremonies, and ocean voyages are all interconnected in Trobriand culture.

Information concerning calendar use in and around the Trobriand Islands is very confusing, with the new year falling at different times of the year separated by nearly four months, even on main island, Kiriwina. However, when new year stars at the evening rise of Pleiades around late October or November starts, it is linked to the outbreak of the *palolo* worm in Indonesia (see Furusawa's chapter).

On Muyuw Island of the Woodlark Islands, which lie east of Trobriands, *bwelim* is a concept that corresponds to our understanding of a solar year. It is divided into four parts, and most people of these islands can specify with precision what stars rise during these parts and how the sun and moon interact within and between these divisions: these two seasons are *nuvid* (east) from February to Septembery and *yavat* from September. to February. Between these two seasons, the people recognized *abalivis* (equinox), literally meaning "dividers" (Damon 1982: 228).

On Muyuw Island, gardening is defined by 13 individual stars. They are relatively evenly spaced in the sky, and their effect on gardening derives from beliefs about their heliacal setting. Upon each stars' setting, it will induce a period of wind and rain followed by calmer and sunnier weather. Ideally, a man cuts a garden during the stormy period, but it should be just before the next star sets, commencing planting with the next rain.

The people say that yams also follow a set seasonal schedule. Yams should be planted according to the Pleiades (*gumeaw*). After February, when in the early evening the Pleiades are some 45 degrees above the western horizon, it is considered too late to plant yams. When yams mature, they become yellow. This is the reason why the people think that the Pleiades urinate on yams, if they do not mature by the heliacal rising of the Pleiades in early June. This suggests that February marks the point after which it is too late to plant yams. It is interesting that garden magic in the east should be performed at dawn whereas in the west it is performed at dusk. This is probably an artifact of east/west orientation to space rather than reference to important temporal factors.

2 Manus

The Manus islanders paid most attention to the night sky in the evenings, observing the constellations over the eastern and western horizon. When stars are visible further up in the sky, they were less carefully regarded. The appearance of *tjasa* (the Pleiades) marked the beginning of the year; *tjasa* is translated as *yar* (year) in Pidgin English. Time is counted in days and nights, and the new moon and the Pleiades count the year. The Pleiades year starts with the appearance of the Pleiades, which coincides with the beginning of northwest monsoon, and twelve lunar months make up one year, without the days being counted precisely (Hoeppe 2000: 30–31).

In October/November, when *ai* (northwest monsoon,

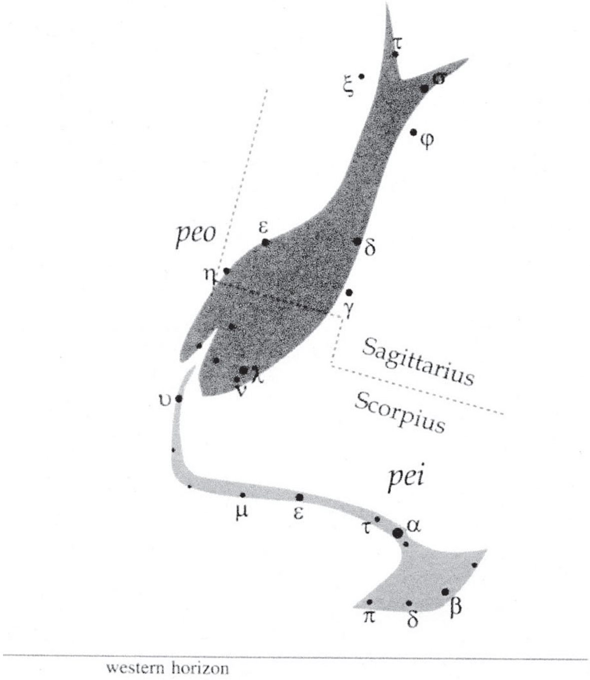


Fig. 3 Manus Constellation: "Shark bites Sringrey"
(Hoeppe 2000: Fig. 2)

rainy season) begins, it is believed that sharks (Sagittarius) bites a stingray's tail (Scorpio), and *tjasa* (the Pleiades) rises in the eastern evening sky (Fig. 3). The Milky Way stretches from north-northwest to south-southeast. During this time, the sea is becomes rough, and there is an abundance of fish. Since these fish constellations set in the sea, the amount of fish increases. At this time yam and taro are also planted.

In March/April, the Milky Way blocks the *ai* wind, and *tjasa* sets in the western evening sky. Fish constellations rise out of the sea, and now the amount of fish decreases. In May, *kup* (southeast-Monsoon, dry season) begins, and the Milky Way stretches from northeast to southwest. In June/July, fish constellations are again seen in the sky, and at the same time, the harvesting period of yam begins. In September, the Milky Way blocks the *kup* wind, and fish constellations set once again into the sea (Hoeppe 2000: 29).

The sun's seasonal motion northward and southward was thought to be due to the actions of the *ai* (northwest) and *kup* (southeast) winds respectively. These were regarded as being responsible for the motion of all celestial objects, and this idea is illustrated by the Milky Way's annual motion. The Milky Way was believed to consist of clouds similar to clouds during the daytime sky, and due to this affinity, the influence of the winds on its motion was evident.

At the beginning of the northwest monsoon season (October/November), a bright patch is visible in the northwest direction, when the Milky Way is stretching from north-northwest to south-southeast. At the end of the northwest monsoon in early May, the Milky Way stretches from the southwest to the northeast. At the end of both monsoon seasons, the Milky Way is visible in those directions at night into which the monsoonal winds would have blown atmospheric clouds.

In between the *ai* and *kup* seasons, the Milky Way stretches from north to south. It was believed to obstruct the winds, causing the calm transition periods between *ai* and *kup*. Only when it was pushed on by the winds, it would turn and let them pass through (Hoeppe 2000: 33).

3 Wogeo, Schouten Islands

The island of Wogeo in the Schouten Islands lie off the northeastern coast of New Guinea. The main crops of the island are taro, yams, breadfruit, banana, nuts such as the canarium almond, and coconut palm. The islands do not produce major crops such as yams in Massim or breadfruit in the Caroline Islands, and there is no ritual development surrounding their harvests. On the other hand, other foods have their own importance on Wogeo.

The islanders prefer bananas and *canarium* almonds to other crops, but these are not staple foods. Breadfruit can be harvested all year round, but the main harvest season is May and June, when it is replaced by taro as the main food source. The sago palm is also of additional importance, and the Tahitian walnut *weaka* is also a favorite, but not a staple (Hogbin 1938).

The most important seasonal phenomenon on the island is the monsoon season, which lasts from November to April or May and is considered to be the rainy season because of the constant rainfall with no change in temperature. During this time the monsoon lasts from November to April (with the *palolo* worm appearance at the beginning of the monsoon). April and May are quiet months when Tahitian walnut is harvested.

Trade winds blows from mid-May to September (breadfruit harvested in May and June, and *canarium* from April (*wabu*) and (*wasek*) in July and August. Then quiet period lasts from September to October.

Here, staple foods are taro and banana, which are available all year round. This eliminates the need for the yam storehouses found in other Melanesian islands. Taro can be harvested five months after planting, but if it is in the ground, it can last up to eight months. The taro fields are only used in emergencies. When the islanders go on a trading voyage to the main islands every few years, they cannot work on their farms, but they can use the taro after they return. The voyage to the main islands would start in July and the voyagers would return in September or October (Hogbin 1938: 133).

Although seasonality in the subsistence cycle was not significant, the busiest time was from April to the end of June to the beginning of July, when the *canarium* almonds are harvested. This is a time of year when rituals tend to be avoided. There is no set time for rituals, but the major rituals involving almonds are held between July and September. The most common time for rituals is late October or early November, when the full moon is seen, and the *palolo* worm lays its eggs.

The seasons can also be read from the changing position of the Pleiades *baras*, when girls undergo an initiation ceremony. The girls perform the *baras losa-losa* ritual of washing the Pleiades. This is a ritual in which young men and women bathe and apply pigment to their faces on the night of the waxing and full moon to pray for proper growth and to ward off illness. This ritual begins in *Bariat*, the northernmost village on the island, and it is believed that “This is the time of year when the Pleiades hangs over this part of the sky at nightfall” (Hogbin 1938: 138).

The islanders stand on the shore of *Bariat* and look out to sea, observing the Pleiades. If they do not need to turn their heads to the right or to the left to see the Pleiades, they believe this month to be February. After a month, the Pleiades will hang over the village of *Dap* at dusk, and the rituals will begin there. Other villages, such as *Bagiau*, also seem to have their own rituals depending on the position of the Pleiades.

To summarize, the rituals are performed during *bariat* (February), *dap* (March) and *bagiau* (April) months, when the *wabu* and *kame* almond harvest takes place, followed by the harvest of *wasek*. This is the *kama* (trade wind season, early August), and after the *kama*, the *yavara* (the monsoon season) begins, and in the middle of the *yavara* season, the *bariat* season comes around again. In July and August, they sail to the main island on the southeast trade winds and return in September and October, which is said to be a quiet time (Hogbin 1938: 139).

III Micronesia

1 Kiribati

For the Kiribati (or Gilbert) Islanders who live in the middle in the Pacific, star observation was very important for both navigation and maintaining calendars. They referred to their indigenous astronomers as *tiamorau*. These astronomers conceived of a system of imaginary lines drawn on the sky by means of which they could estimate the altitude of stars. They thought of the sky as the “roof of voyaging,” the ridgepole of which was the meridian, a line running from the north point on the horizon through the zenith to the south point. They referred to the horizon as *te tatanga*, “the roof-plate.”

The sky roof was supported on upright rafters, *oka*, three on the east and three on the west (Fig. 4). One end rested on the horizon, the other on the ridgepole or meridian. The northern pair met at a point 24 degrees north of the celestial equator where the Pleiades crossed the meridian. The southern pair had their apex at a point where Antares culminated, 26 degrees south of the equator (Grimble 1972).

The middle pair of rafters did not coincide with the equator and met in the zenith as one would expect, but had their apex where the star Rigel culminated, 8 degrees south of zenith (Fig. 5). This indicates that Gilbert Islanders originated in an area 8 degrees to 10 degrees south of the equator where Rigel passed through their zenith (Makemson 1941: 107).

Between the horizon and the meridian, and also parallel to the horizon, the Gilbert Islanders imagine three crossbeams or purlins, forming four equal zones

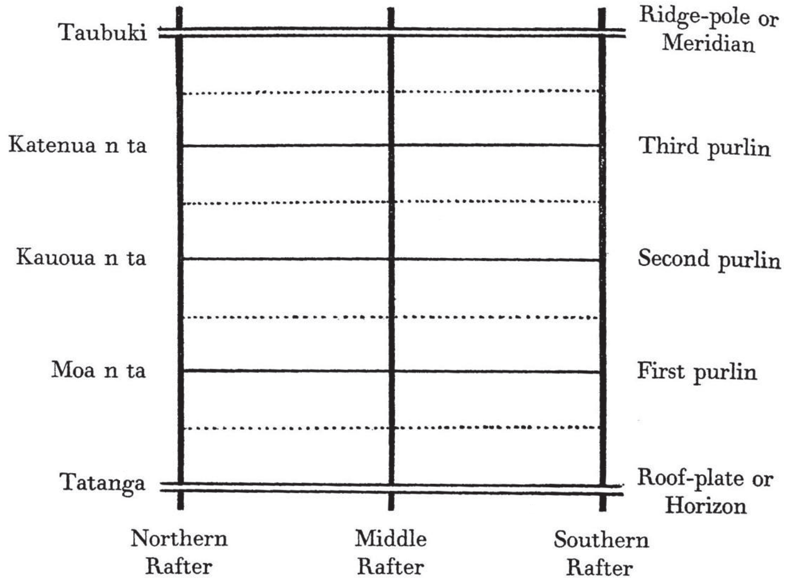


Fig. 4 Imaginary "rafter" in the Sky, Kitibati (Grimble 1972: $$$$)

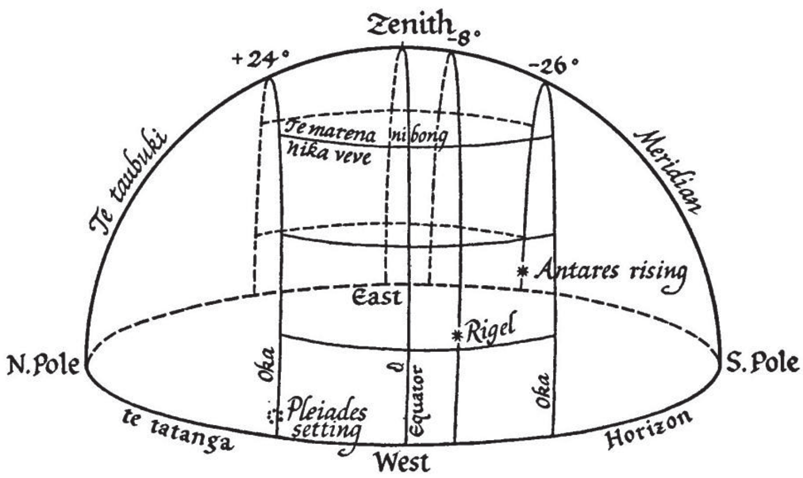
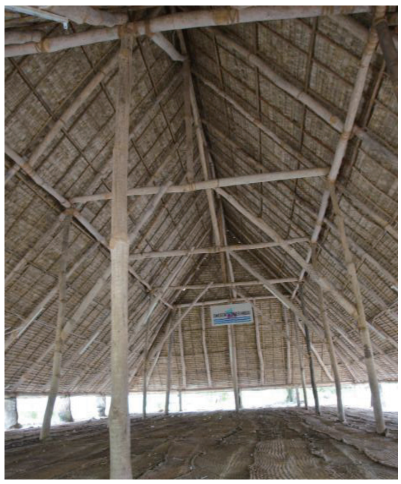


Fig. 5 Kitibati Image of the Stellar Calendar (Makemson 1948: Fig. 4)



a **b**

Fig. 6 Traditional Meeting House (a) and its Roof Structure (b)

(Grimble 1972). The purlins were numbered from the eastern horizon to the meridian and down from the meridian to the western horizon (Fig. 6). Each of the four zones formed on either side and bounded by the purlins and the rafters were thought to be divided into two parts, the eastern half being called *te marena ni bon* (the interval of days), and western half known as *nika-vere* (sacred enclosure).

The year began late in November or early in December with the first appearance of the Pleiades after sunset, at an altitude of 10 to 12 degrees. The Pleiades season ended when *Rimwimata*, Antares, was visible in the same position June 15–20, when the *tannki* season began. In the meantime, the Pleiades had climbed the successive purlins as seen in early evening and was finally disappearing in the west (Makemson 1941: 107–108).

The Gilbert Islanders divide their year into two seasons: "*Te Auti*," which lasts from early December to early June, and "*Te Rimwimata*," which lasts from early June to early December. Each of these seasons is subdivided into eight shorter periods called *bong*, whose duration is determined by observation of the successive altitudes of the seasonal star at the hour after sunset. The first *bong* of "*Nei Auti*" lasts from the beginning of the year, *ririki*, until the cluster is seen to stand at the altitude of the first purlin just after sunset. The second *bong* begins when the cluster is just past the first purlin at the same hour; the third when it is past the second purlin; the fifth when it is to westward of the ridge-pole; and so on. This continues until the passing of the third purlin westward after sunset until the eighth *bong*. The same method is used in counting the *bong* of the *Rimwimata* season, the star Antares being used instead of the Pleiades, and then *tanki* season begins (Grimble 1972: 224).

Each *bong* is named after some natural phenomena. For example: (1) "*Te Kunei*" (late November to December 8) is a common noddy (*Anous stolidus*) which is a better indicator for navigation than any other season; (2) to (3) refer to common flies that infest villages during these periods; (4) and (5) refer to when the climate becomes gradually favorable to ocean voyage, when the cluster passes the meridian at sunset, the fair weather with southeast trade wind sets in (February 16 to April 1); (6) and (7) refer to *aibwea*, the first glimmer of light before dawn and a favorable time to start voyage (April 2 to April 24). The fair-weather season for navigation lasts from *Tukabu n Auti* (February 16 to March 10) to *Mannawawa* (August 28 to September 19), from the culmination of the Pleiades after sunset to the culmination of Antares at the same hour (Grimble 1972: 225 note 1).

2 Carolinian Islands, Micronesia

In the Carolinian Islands, the heliacal rise of a star usually marks the beginning of the sidereal month bearing its name. The temporal sequence of star names is largely the same in all of the islands, and it is a proof that the calendars are based on relative right ascensions of stars (Goodenough 1953: 25). However, the number of sidereal months varies among the islands and the several schools of navigation. In the western Central Caroline Islands, one year consists of twelve months, but in eastern islands (Polowat and Satawal), one year consists of fourteen or fifteen months.

There is also variation in the stars used. In these instances, the choice falls between two stars of similar right ascension, and there is a calendar which includes them both. With the exception of Crux (which appears as a month name on *Namonuito* and Pulowat in place of Corvus), all the stars used have declinations that do not greatly exceed the limits set by extreme north and south points of the eclipse (Goodenough 1953: 25).

In the Carolinian star calendars, however, researchers have observed that the number of seasons in a year deviate widely from ten to eighteen. The number of days in a season also differs. Goodenough noted that the astrological calendar is based on the knowledge of the navigators, who observe the stars in great detail, which results in years being counted as more than twelve or thirteen months (Goodenough 1953). If we ask them about the name of a particular month, some will answer the name of the star that rises in the early part of the month, and others will answer the name of the star that rises in the latter part of the month. If the time lapse, the navigator's constellation could become eighteen months, or the same month could be called by different

Table 1 Constellations in Indigenous Calendar on Chuuk
(modified from Goodenough 2002: Table 8)

Star or constellation	*name*	*right ascension*
1. α Scorpii (Antares)	*tumwur*	16:25
2. α Lyrae (Vega)	*méén*	18:35
3. α Aquilae (Altair)	*máánap*	19:50
4. α Equulei	*sééta*	20:35
5. β Pegasi	*naa*	23:00
6. β Andromedae	*kúúw*	1:05
7. γ Andromedae	*enimaté*	2:00
8. η Tauri (Pleiades)	*mweeriker*	3:45
9. α Tauri (Aldebaran)	*wuun*	4:40
10. δ, ε, ζ Orionis (Orion's belt)	*énúwén*	5:35
11. α Canis majoris (Sirius)	*maan*	6:45
12. Crater	*ónumas*	11:00
13. Corvus	*serepwén*	12:20
14. α Virginis (Spica)	*ááp*	13:25
15. α Bootis (Arcturus)	*óromwoy*	14:15
16. Corona borealis	*cheew*	15:30

constellation names depending on the person.

Chuuk Island's people believed they could only count on a good bread crop if the spirit essences of the fruit came from the south each year and settled on their trees, leading them to *sawit*, which is the form the first visible budding of fruit. The Milky Way (*anenimey*, "path of breadfruit"), marked the route by which the spirit essences came to Chuuk from the south. The cycle of rituals performed by the breadfruit summoner was necessary to assure that these spirit essences would come and provide an abundant harvest (Table 1).

When the ancestors of the Chuuk People came to Suuk (Pulusuk) under the leadership of Load of Breadfruit (*Sowumey*), they found Suuk to be a barren island where no fruit trees were able to survive. The lord ordered them to bring him the outrigger float (*taam*) from their canoes. He planted these floats, which were made of breadfruit wood. The float took root and grew into breadfruit trees. This is the origin of breadfruit summoning ritual; the ritual reenacts this incident (Goodenough 2002: 193).

The ritual is performed in a special meeting place by men only, secluded off by hoisting leaves and flowers of a certain plants. Outrigger floats are buried vertically to create a scene that reenacts the origin myth. In front of the meeting house, the outrigger float of a canoe was buried upright in the ground to represent the buried outrigger over which Lord Breadfruit had performed the original ritual on Suuk Islan (Pulusuk). The Milky Way appears to lie from north to south in March and April, which is the time when the people pray for the good fruit (Goodenough 2002: 194).

The summoner began his work in the traditional star month of Seeta and persisted continually through the next star month of Naa (roughly from April to mid-May, Pegasi) leading up to the appearance of fruit on the breadfruit trees (i.e. toward the end of the *efen* season of northeast trade winds and the beginning of the *raas* season of Southwestern winds). Then follow months of March (Equuli), April (Pegasi), May (Andromedae β), June (Andromedae α), and July (Pleiades). One year consists of sixteen months, and the last month would come right after June solstice when Pleiades make heliacal rise.

IV Discussion

The calendars of the Austronesian voyagers in Oceania may have a common element inherited from their ancestors in Southeast Asia. For example, the calendar is based on the Pleiades and Antares, and is likely based on the relationship between the Milky Way and the monsoons. However, adaptations on individual islands are different, such as whether to observe the stars in the morning or in the evening. One of the reasons for this is that they moved from the northern

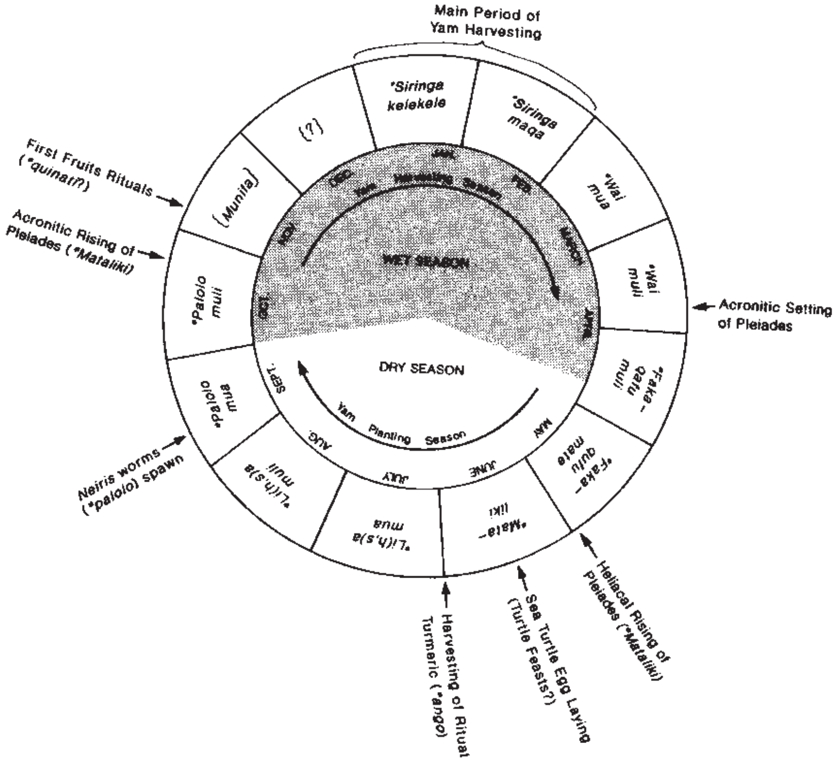


Fig. 7 Hypothesized Calendar at Proto-Polynesian Language Stage

(Kirch and Green 2001: Fig. 9.5)

hemisphere to the southern hemisphere, nearly 60 degrees of latitude at different times and thus began to see celestial objects differently.

There are two important natural phenomena related to the Oceania calendar: the alternation of the wet and dry seasons, and the constant change of winds (trade winds). The wet and dry seasons are related to agriculture and food gathering, while the wind is closely related to navigation. In addition, the outbreak of the *palolo* worm was important. This worm is distributed from the islands off the northeast coast of New Guinea and reaches as far as Samoa and Futuna in western Polynesia. The importance of this worm as a calendar index can be inferred from the fact that in Samoa, it is used as the name of the month that marks the start of the new year. Even in the Cook Islands and Tahiti, where the *palolo* is not distributed, the name *paroro* was retained as the name of the new year month or constellation.

Concerning the Lapita culture, which is believed to have been the ancestor of Austronesian culture throughout Oceania, Kirch and Green suggest the following features of the prototype calendar at Proto-Polynesian Stage (Fig. 7).

(1) A yearly system consisting of alternation of wet and dry seasons (**taqu*). In Western Polynesia, **taqu* referred to the season of the yams, but in Eastern Polynesia, where yams are no longer cultivated, it has become an abstract term referring to the season or year.

(2) Two seasonal divisions based on the appearance of the Pleiades in the eastern sky in the evening (acronitic rise) and in the eastern sky at dawn (heliacal rise). It is noteworthy that the two seasons of the Pleiades corresponded to the planting of yams at the beginning of the rainy season, around November, and the harvesting at the beginning of the dry season, around June.

(3) A year consisted of twelve or thirteen months based on the age of the moon. The lunar year was corrected for the solar year with an intercalary month (Kirch and Green 2001: 273).

The question of when the year begins may also be a subjective one. In general, the acoustic or heliacal rise of the Pleiades was the focus of Oceania voyagers. This is because it is related to the solstice of the sun and conversely corresponds to the rise of Antares. The choice of which to celebrate as the start of a new year would have differed from island to island, as shown by the fact that Hawaiʻi and Tahiti in Polynesia and Aotearoa (New Zealand) and Rapa Nui (Easter Island) are reversed. The concept of a "new year" itself needs to be questioned. The year was marked by the harvesting, reaping, or planting of important foods, as well as the direction of the wind, which varied from island to island (and from crop to crop).

The rising or setting points of the constellations, together with the changes in the sun's rising and falling points, form the basis of orientation and seasonal views. At the same time, the direction of the Milky Way corresponds to changes in the wind.

Constellations are not always about observing the stars themselves. The smaller clouds (the Pleiades) and the larger clouds (the Milky Way) are also important. How to observe the Pleiades varies from island to island, such as when they appear in the western sky at nightfall or when they climb at a certain angle. In particular, the Milky Way crossing the sky seems to be understood as a phenomenon that governs the relationship with wind shifts (e.g. in Manus and Chuuk).

Both the sun and the moon were also important to the voyagers of Oceania. The rising and setting of the sun indicated direction and season. The moon was an indicator of tides and the passage of time. However, migration to many of the discant Polynesian islands required voyaging during the night. In the daytime, there were indicators such as birds, clouds, and coral reefs, but at night, the stars were the essential indicators of direction. The Milky Way was not only an indicator of direction, but also an indicator of wind direction, which was necessary for navigation.

V Conclusion

The night sky, "the immense screen of the starry night" (G. Bachelard's pxpression cited in Hoeppe 2000: 35), is a screen onto which not only a calendar, but also a narrative of annual environmental variation and local fauna/flora is inscribed. Together with this, creation myths, mythical origins of cultural practices (such as the origin of crops like breadfruit), and memories of ancestors are projected to the night sky. The changing modes of the night sky are synchronous with the seasonal cycle, and therefore to identify constellations in the visible pattern of stars makes it possible to attribute to them meanings which are in accordance with seasonal change. The construction of causal analogies between the everyday experience and constellations, makes them meaningful as agents which bring about seasonal change (Hoeppe 2000: 35). Additionally, night sky is a mnemonic device to remember and reexperience ancestors' mythical history (Kelly 2017).

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References

Anderson, A.
2018 Seafaring in Remote Oceania. In: Cochrane and Hunt [eds.], *Oxford Handbook of Prehistoric Oceania*, pp. 473–493. Oxford: Oxford University Press.

Austen, Leo
1939 The seasonal gardening calendar of Kiriwina, Trobriand Islands. *Oceania* 9: 237–253.

Bellwood, P. and P. Hiscock
2018 Australia and the Indo-Pacific Islands during the Holocene. In C. Scarre (ed.) *The Human Past: the World Prehistory and the Development of Human Societies*, pp. 261–302. London: Thames and Hudson.

Damon, Frederick H.
1982 Calendars and calendrical rites on the northern side of the Kula Ring. *Oceania* 52: 221–239.

Goodenough, Ward H.
1953 *Native Astronomy in the Central Carolines*. Phil adelphia: University of Pennsylvania Museum.

Goodenough, Ward H.
2002 *Under Heaven's Brow: Pre-Christian Religious Tradition in Chuuk*. Philadelphia: American Philosophical Soceity.

Goto, Akira, Ohnishi Hideyuki and Tomo Ishimura
2019 A Report on the Reassessment of Navigation Stones on Arorae, Kiribati. *People and Culture in Oceania* 35: 109–125.

Grimble, A.
1972 *Migration, Myth and Magic from the Gilbert Islands*. London: Routledge & Kegan Paul.

Hilder, Brett
1959 Polynesian navigational stones. *Journal of the Institute of Navigation* 12: 90–97.

Hoeppe, Götz
2000 When the shark bites the stingray: the night sky in the construction of the Manus world. *Anthropos* 95: 23–36.

Hogbin, Ian
1938 Tillage and collection. *Oceania* 9: 127–151.

Kirch, P. V. and R. Green
2001 *Hawaiki, Ancestral Polynesia*. Cambridge: Cambridge University Press.

Kelly, Lynn
2017 *The Memory Code*. New York: Pegasus Books.

Leach, Edmuud R.
1950 Primitive calendars. *Oceania* 20: 245–262.

Makemson, Maud W.
1941 *The Morning Star Rises: An Account of Polynesian Astronomy*. New Heaven: Yale University Press.