ASTRONOMICAL ASPECTS OF "PRANOTOMONGSO" OF THE 19th CENTURY CENTRAL JAVA

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It has been shown by Aveny (1981) that the development of indigenous astronomical systems in tropical cultures, whether the motive was religious or practical, centered toward a reference system consisting of zenith and nadir as poles and the horizon as a fundamental reference circle. Such a reference system differs remarkably to the celestial pole-equator (or ecliptic) systems employed by civilizations in temperate zones (also see Brennand, 1896; Stencel, et.al., 1976).

In order to obtain more insight of the view expounded by Aveny (1981) the authors undertook a test case study of the astronomically related time-keeping practice in Java. "Pranotomongso" has been chosen as it is well documented since 1855. According to Daldjoeni (1984) the " pranotomongso" (literaly means the arrangements of seasons) functions well as a practical guide for agricultural activities for the rural peasants in Central Java. The basis of "pranotomongso" is shown schematically in Fig. 1.

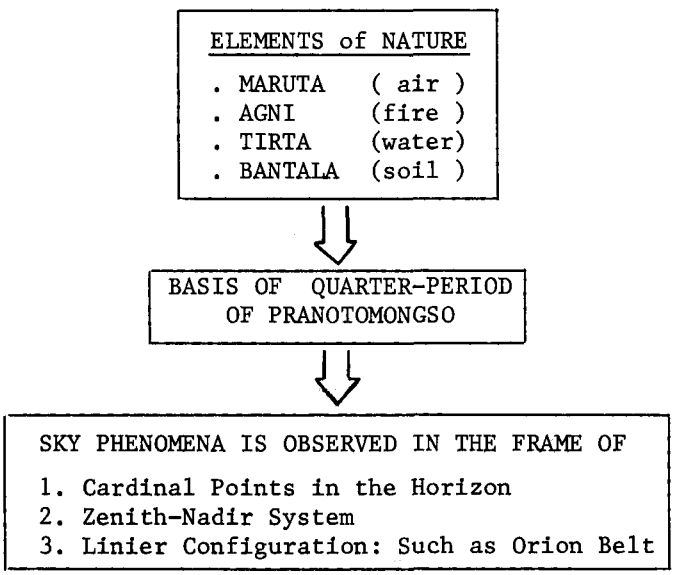

Fig. 1. The basic of "pranotomongso"

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The root of the calendar system can be traced back to the old Mataram Kingdom which flourished in the 9th century.

Although according to van Hien (1922, op. cit. Daldjoeni (1978) the use of the time-keeping system started long before the Hindu immigrants arrived from India, the elements of Hindu were later incorporated in it, as can be seen in the names of the stars and star constelations (Maas, 1924; Thiele, 1974). Daldjoeni (1983, 1984) shows the Sanskrit's name of the months which are widely used in the system of "Pranotomongso". It can be seen that there are no extraordinary deviation of orthography, which is Sanskrits.

While the essence of "Pranotomongso" is a tropical year of 365 days, consisting of twelve months of unequal lengths, the calendar reflects also a concept of the world's view of the people in the archipelagoes. Its division into seasons fits the bioclimatological and sociocultural aspects of agricultural activities in the area (of Central Java). Table I shows part of the system related to bioclimatology aspects.

TABLE I. RYTHM of THE SEASON
(Example of character and phenomena of the months)

KASA (KARTIKA) 22/6	. Sotya murca ing embaran (a jewel drops from its setting)	Plants Corn; Cotton; or other Roots Plants
	. Clear Sky; Falling Stars	(Cassava)
DESTA (PADRAWURA) 19/4	. Sotya Sinarawadi (a jewel appears)	Rice Crops; Kapok trees
	"Bird eggs to be hatched"	flowering
SUDDHA (ASUDJI). 12/5	Tirta Sah Saking Sasana (Water gets away from its place)	Festival
	. Cold night, end of rain	

The names of bright stars or apparent clustering of stars that are used to denote the season are mostly, understandably, agriculturally oriented. There are, however, some ambiguities as which stars (or star groupings) are more apropriate for a certain months. A careful examination indicates that:

1. Almost always, bintang Luku (ε, δ and Σ. Orionis; the Belt of Orion) and Bintang Wuluh (Pleaides and, probably, includes Eta Tauri) are

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employed to note the beginning of the season. Their positions in the sky, at the times of sunrise or sunset, with respect to the horizon serve as the clock. This strengthens Aveny's view stated above that horizon forms the basic reference. Pannekoek (1961) has also noted that when the Orion's belt is invisible work in the fields ceases and its morning rise (in December) indicates the beginning of the agricultural years.

2. The division of the year into 12 twelve, unequal length, of months can be obtained closely by dividing the apparent orbit of the sun in the sky. For a place in Central Java, which mean geographic latitude is about -7^{o}, the shadow of a sundial casts by midday-sun on June 22 (when the sun is at summer soltice) is twice as long as the shadow in December 21 (when the sun is at winter soltice). The total length of the shadow, which runs exactly north-south, is then divided into six unequal parts which form the first half of the year. The other half of the year is the time taken by the midday sun to trace back the shadow from its extreme north to the extreme south ends.

3. The sign of the month in the night sky must be viewed rather carefully, as the positions of the star groupings may not be exactly given. The most obvious example is the use of the same zodiac symbol for the 2nd Month, (Pusa; 2 August-24 August), and the 12th month (Asudji, Saddha, 12 May-21 June). Both months is under the star grouping which is called "tagih". "Tagih" may represent the whole stretch of the "Milky Way", instead of a single grouping. This is to be contrasted with the use "Bimasakti"--which refers to Sagittarius Cloud, which sets together with the sun at approximately December 22.

Identifications of some Javanese constellations with the commonly used nomenclature in astronomy is shown Table II. Note that the

TABLE II. NAME of STARS

Badak Nyempal	- α Canis Mayoris (Sirius)
Banyak Angrem	- Southern Coalsack
Bima Sakti	- Sagittarius Cloud, probably the whole Southern Milky Way from Norma to Sagittarius
Gotong Mayit	- Head of Scorpio
Hasta	- α, β, Corvus
Kalapa Doyong	- β, δ, π, α, τ, ε, Scorpio
Krittika (Bintang Tujuh)	- Pleiades (May include η Tau)
Lumbung (Gubug Penceng)	- Crux
Waluku	- δ ε Orions (The Orion's Belt) X Orionis may be the bull
Wuluh	- Pleiades (= Bintang Tujuh) but some says: Wulu, which is probably Hyndes
Wulanjar Ngirim	- α and β Centauri

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boundary of the groupings are not, as one might have expected, overlapping. There are indications that some names refer to certain stars only.

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