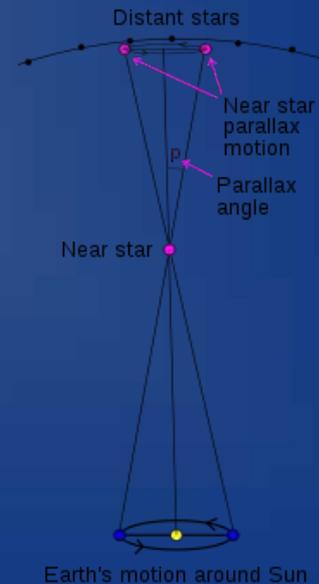


Why did the ancient Greeks reject the notion that the Earth orbits the sun?

- It ran contrary to their senses.
- If the Earth rotated, then there should be a “great wind” as we moved through the air.
- Greeks knew that we should see stellar parallax if we orbited the Sun – but they could not detect it.

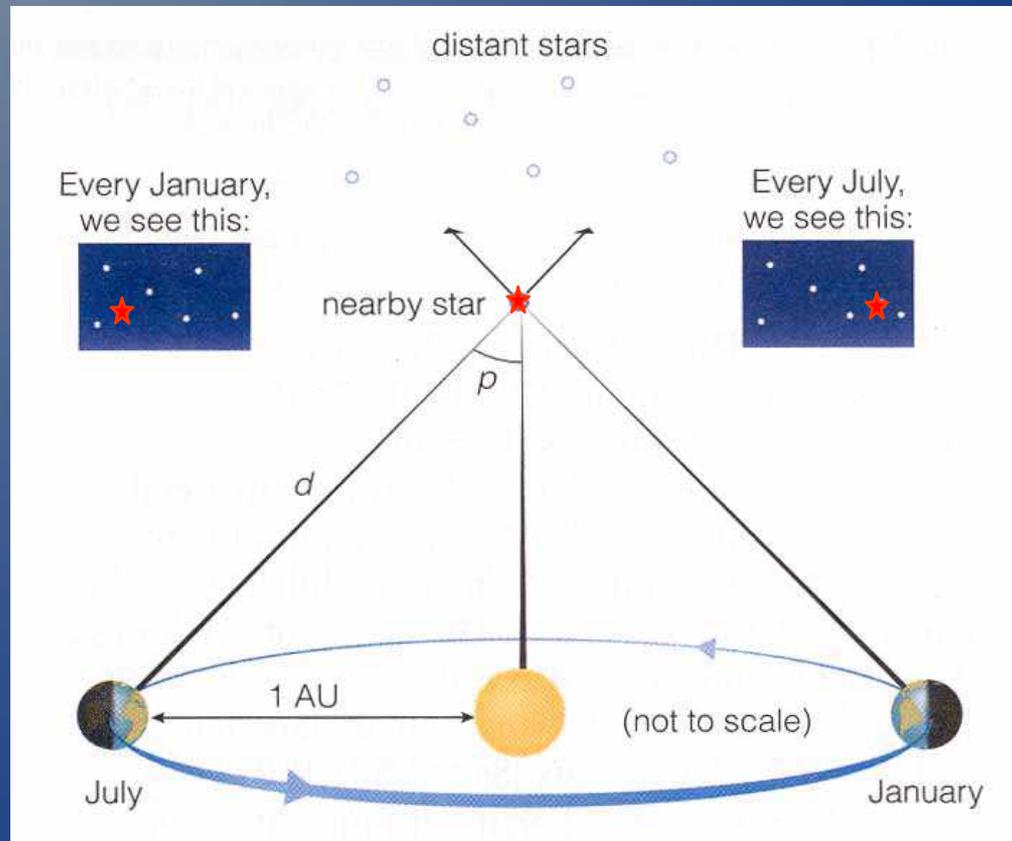


What is parallax? You use it every day...



Parallax Angle

Apparent shift of a star's position due to the Earth's orbiting of the Sun



Possible reasons why stellar parallax was undetectable:

1. Stars are so far away that stellar parallax is too small for naked eye to notice
2. Earth does not orbit Sun; it is the center of the universe

Unfortunately, with notable exceptions like Aristarchus, the Greeks did not think the stars could be *that* far away, and therefore rejected the correct explanation (1)...

Thus setting the stage for the long, historical showdown between Earth-centered and Sun-centered systems.

Scientific Thinking

- It is a natural part of human behavior.
- We draw conclusions based on our experiences.
- Progress is made through “trial and error”.

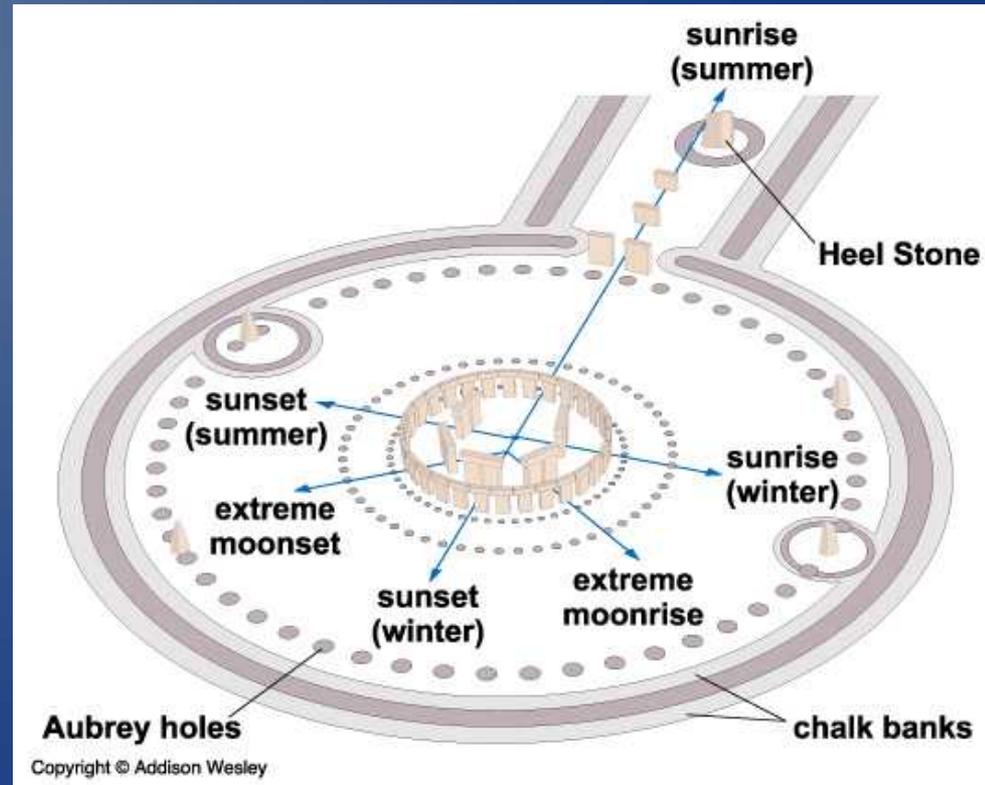
Ancient Astronomy

- Many cultures throughout the world practiced astronomy.
- They made careful observations of the sky.
- Over a period of time, they would notice the cyclic motions of:
 - Sun
 - Moon
 - planets
 - celestial sphere (stars)

Stonehenge (completed 1550 BC)

This famous structure in England was used as an observatory.

- If you stand in the middle:
 - the directions of sunrise & sunset on the solstices is marked.
 - the directions of extreme moon rise & set are marked.
- The Aubrey holes are believed to be an analog eclipse computer.



Mayans (fl. A.D. 400 – 1200)



the Observatory at Chichén Itzá

- lived in central America
- accurately predicted eclipses
- Venus was very important
- marked zenial passages
- Mayan mathematics
 - base 20 system
 - invented the concept of “zero”

Anasazi (ca. A.D. 1000)

- lived in “four corners” area of SW USA
- built structures to mark solstices and equinoxes



Pueblo Bonita at Chaco Canyon, NM



Sun Dagger at Fajada Butte

Plains Tribes of N. America

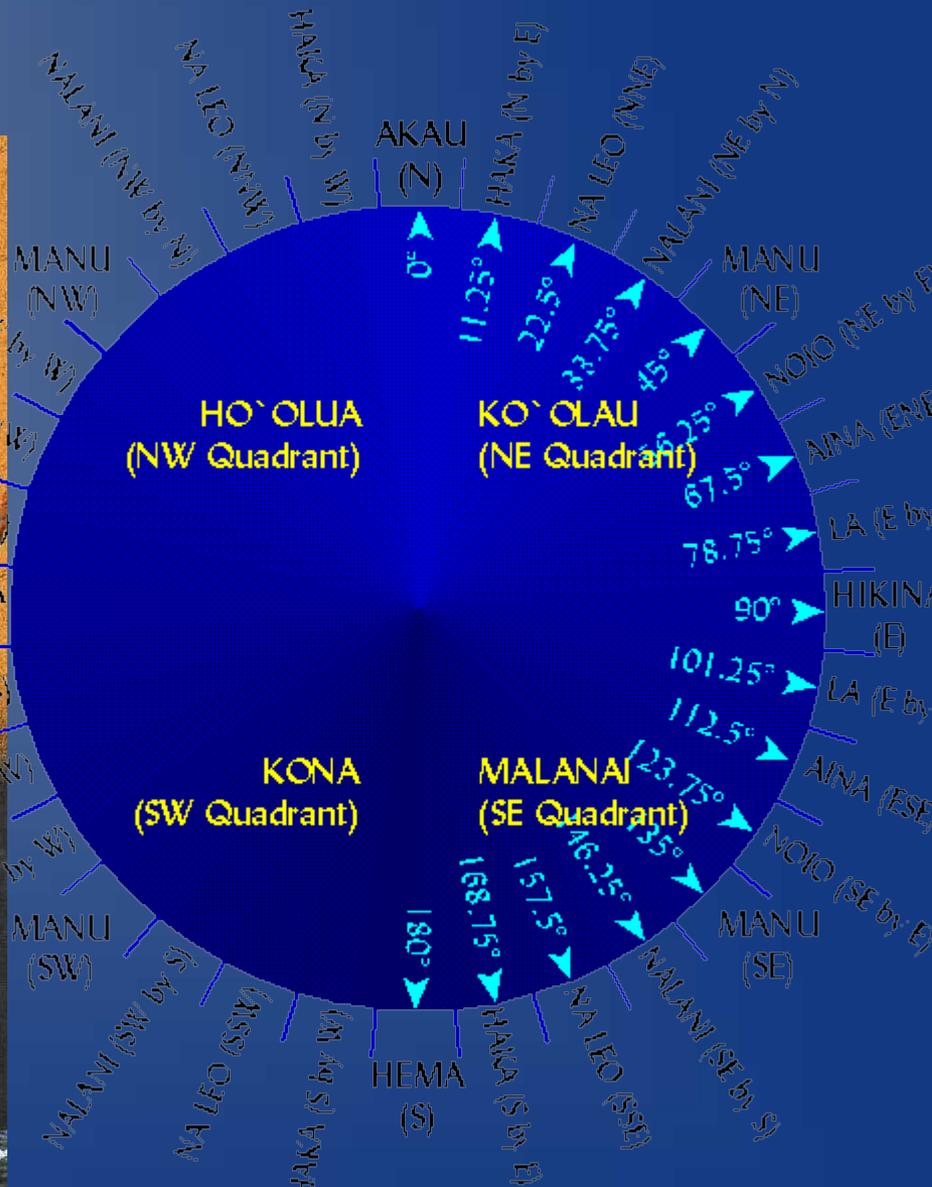
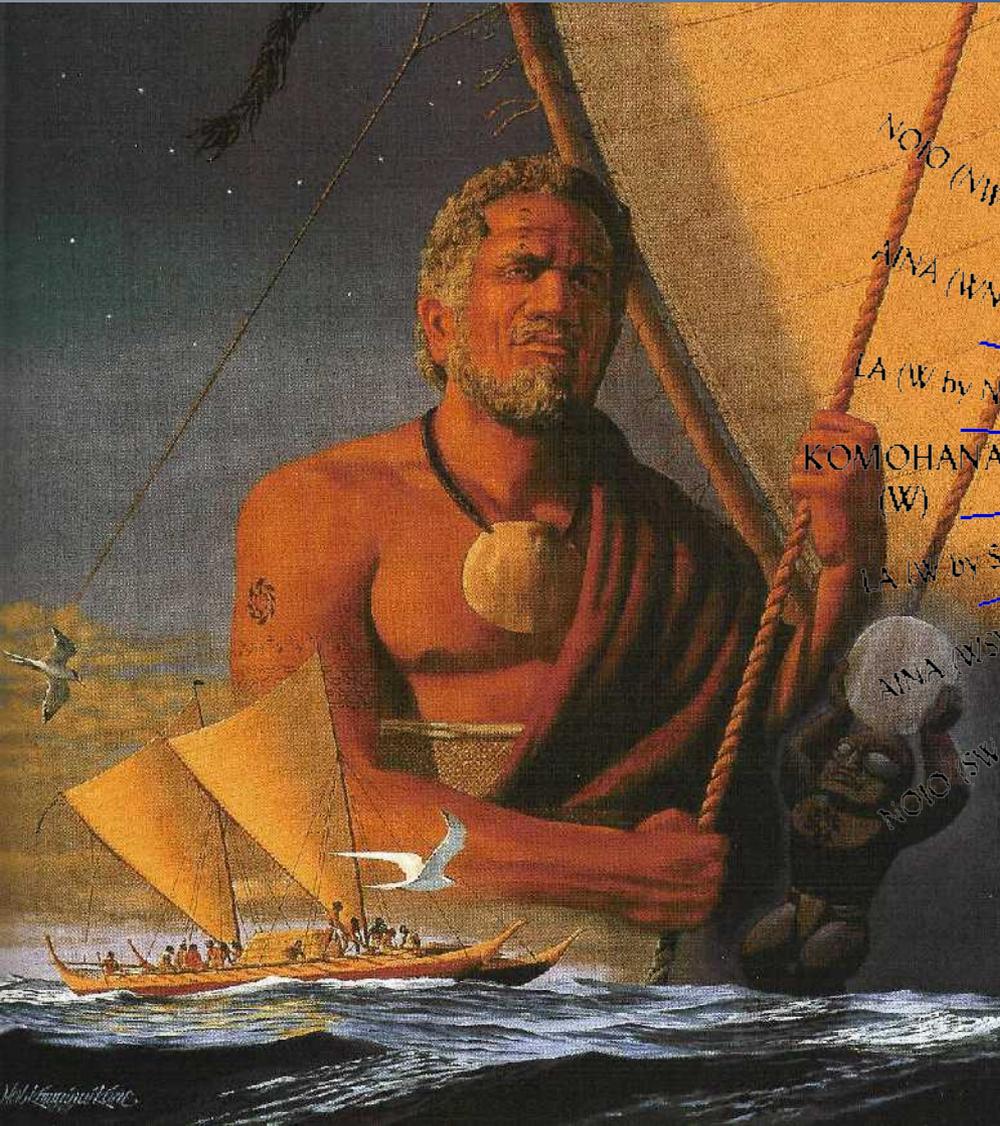


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Big Horn Medicine Wheel, WY

- star maps and sighting circles were drawn on the ground to mark:
 - solstice rising points of Sun
 - helical rising points of stars

First Astronomy Observatories in Hawai'i ?



Modern Star

“Not-So-Ancient” Hawaiians

Currently believed to have established outposts as early as ~400 B.C. and permanent settlements by ~300 A.D.

Ni'ihau
Kaua'i

O'ahu

Moloka'i

Lana'i

Kaho'olawe

Maui

Hawai'i



Moÿike ha



directed his foster-son Kamahualele to make ready a double hulled canoe. “Let’s go to Hawaiÿi”, he said. “Here I’m tormented by my love for Lu’ukia; when the ridge-pole of my house Ianikeha disappears below the horizon, I’ll no longer think of Tahiti.”

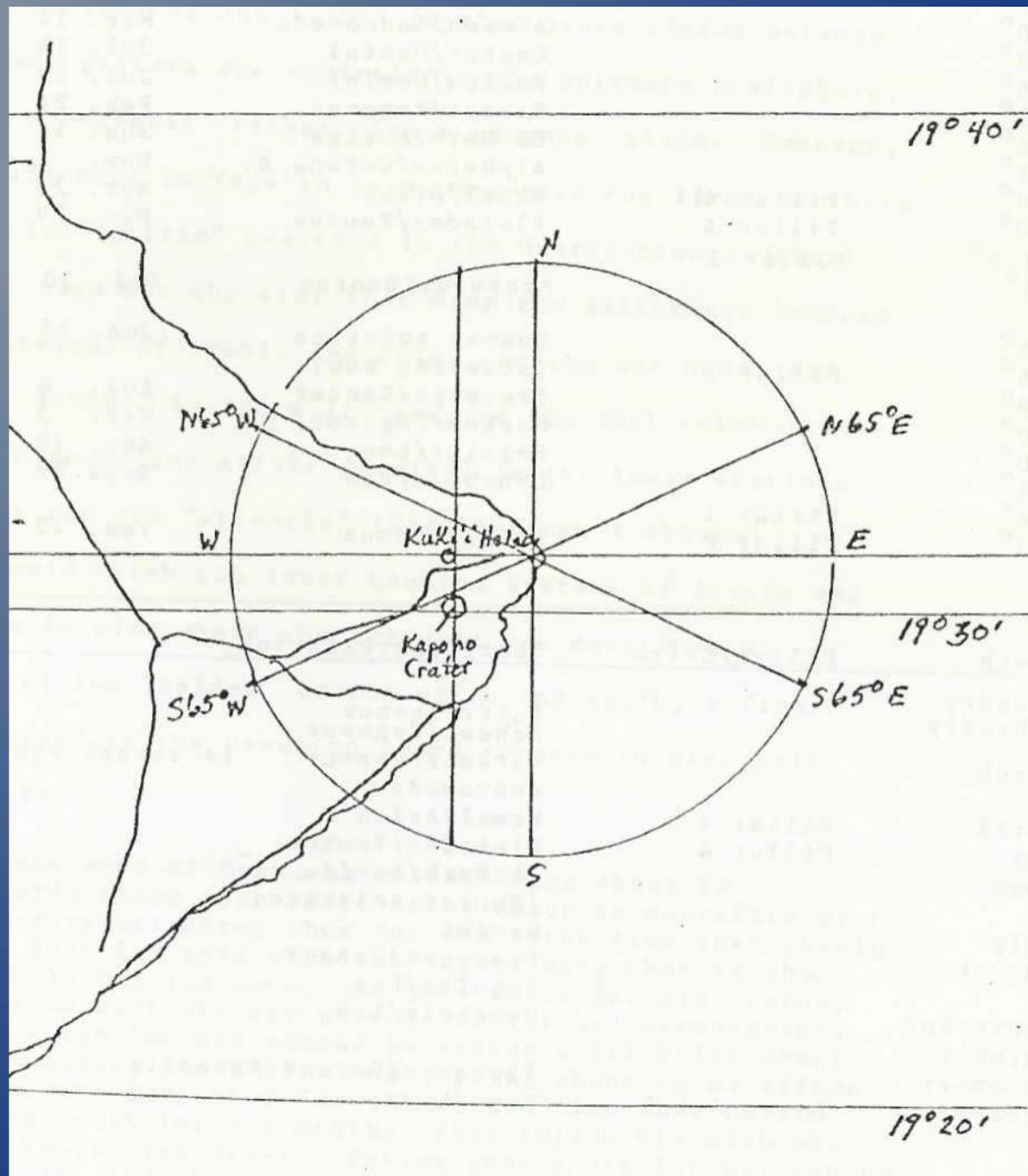
Kamahualele directed the paddlers to get the double-hulled canoe ready. Moÿikeha planned to take his sisters, Makapuÿu and Makaaoa, his two younger brothers, Kumukahi and Haÿehaÿe, his priest Moÿokini and his prominent men (na kanaka koikoi) – navigators (hoÿokele), favorite priests (kahuna punahele), and his lookouts (kiu nana), who would spy out land.

**Early one morning at dawn,
at the rise of the navigation
star (ka hōkū hojokelewaia;
possibly Sirius), Mo'ikeha
boarded his double-hulled
canoe with his fellow
voyagers (hoa holo) and left
Tahiti.**

**All went well (holo pono)
from the morning of
departure until the sunrise
when they first beheld
Maunakea. Kamahualele
stood up and celebrated their
arrival in Hawai'i with the
mele which appears to the
right:**

Behold Hawai'i, an island, a man
A man is Hawai'i
A man is Hawai'i
A child of Kahiki
A royal bud from Kapa'ahu
From Moa'ulanuiakea Kanaloa
A descendant of Kahiko and Kapulanakehau
Born of Papa,
The daughter of Kukalani'ehu and Kahakauakoko
Sprouts of land in a line
Placed alike to the East, to the West
Arranged evenly in a line
Joined to, joined from Holani
Kaialea, the seer, circumnavigated the islands
Left Nukuhiwa behind; landed on Borabora
Kahiko is the source of land
He divided and separated the islands
Severed the fish-line of Kaha'i
Cut by Ku-Kanaloa
Divided up was the lands, the islands
Cut by the sacred bamboo knife of Kanaloa
Of Haumea Manukahikele
Mo'ikeha is the chief who will live there
My chief shall dwell in Hawai'i
Life! Life! Set life free!
Long live the chief, the priest,
Long live the seer, the servant,
They shall dwell quietly in Hawai'i
The grandchildren will sing out on Kaua'i
Kaua'i, the island
Mo'ikeha, the chief.









Ni'ihau
Kaua'i

O'ahu

Moloka'i

Lana'i

Kaho'olawe

Maui

Hawai'i

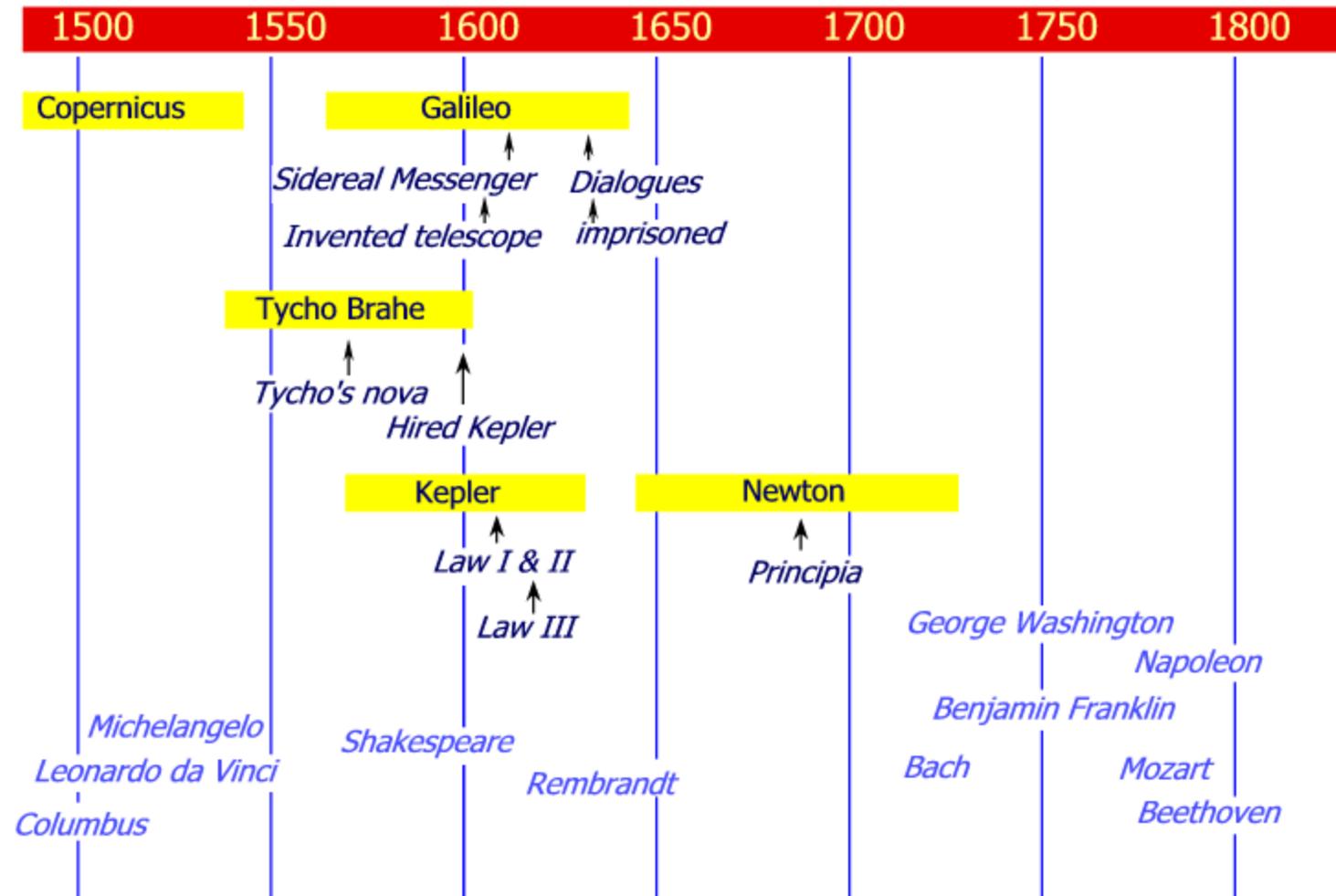


The Battle of Ahuaumi

Keliokaloa the ruling chief of Kona, Attacked Umi a Liloa on the broad plain between Mauna Kea, Mauna Loa, and Hualalai. With the help of Piimaiwaa, Umi was victorious and became chief of the whole island. He built Ahuaumi to commemorate this important battle.

(circa ~1600 AD)

Important years for astronomy



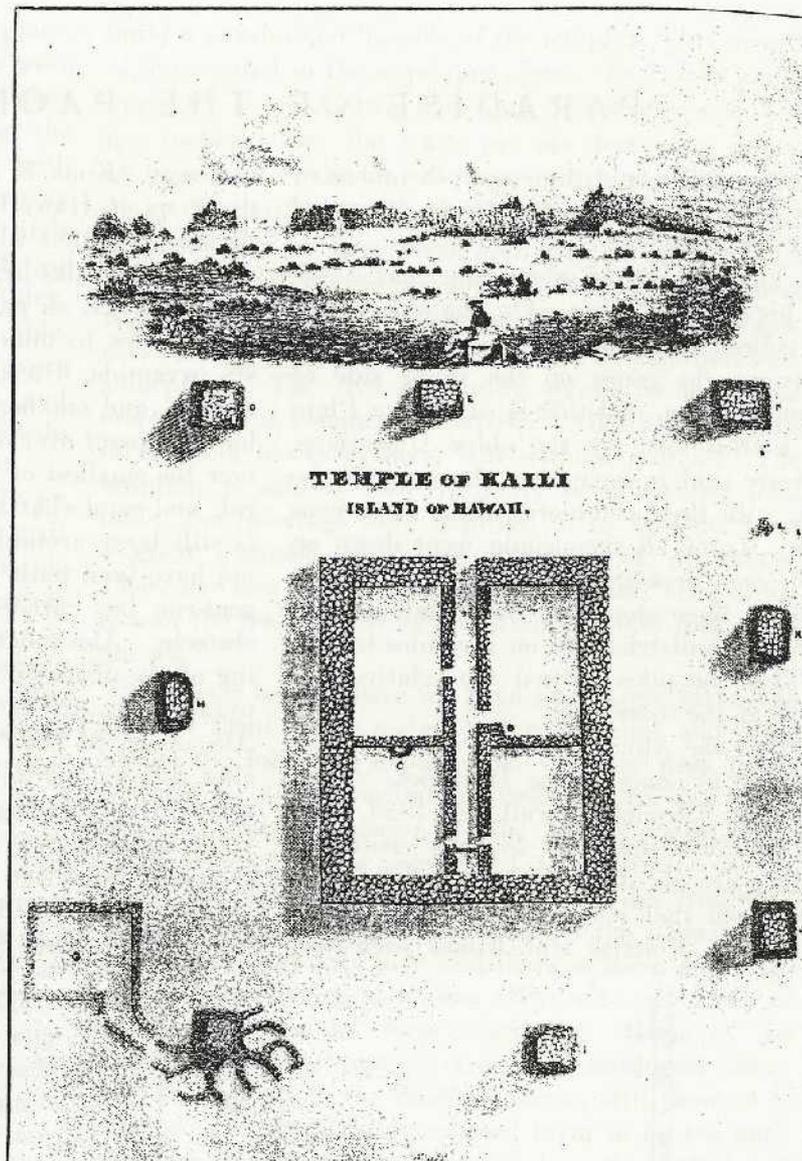
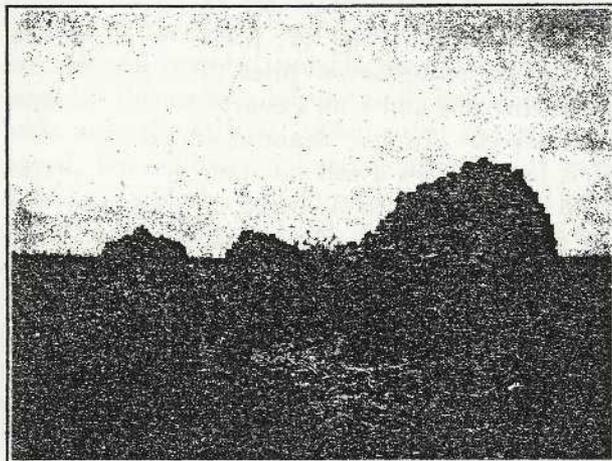
AHUA A UMI

Description of an Ancient Temple on
Island of Hawaii

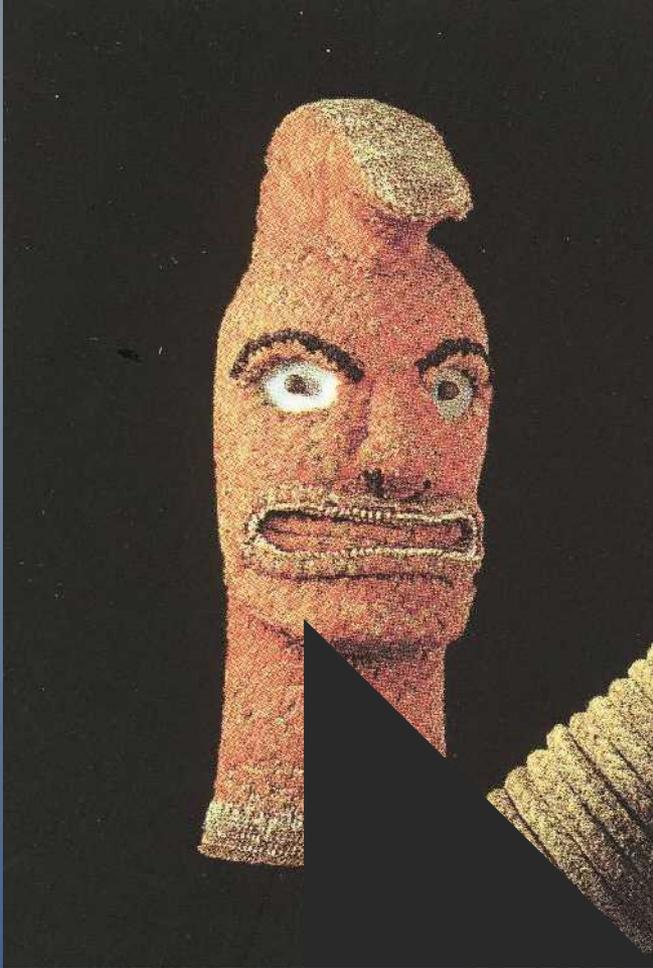
BY ALBERT S. BAKER, M.A., M.D., B.D.,

in

THOS. G. THIRUM'S HAWAIIAN ANNUAL
(The Reference Book of Hawaii)
for 1917



Left—East Stone Piles. Right—Wilkes' Plan of Ahua a Umi.



Lono

**Ke
o
Ku**

**Ke
o
Ur
kapu**

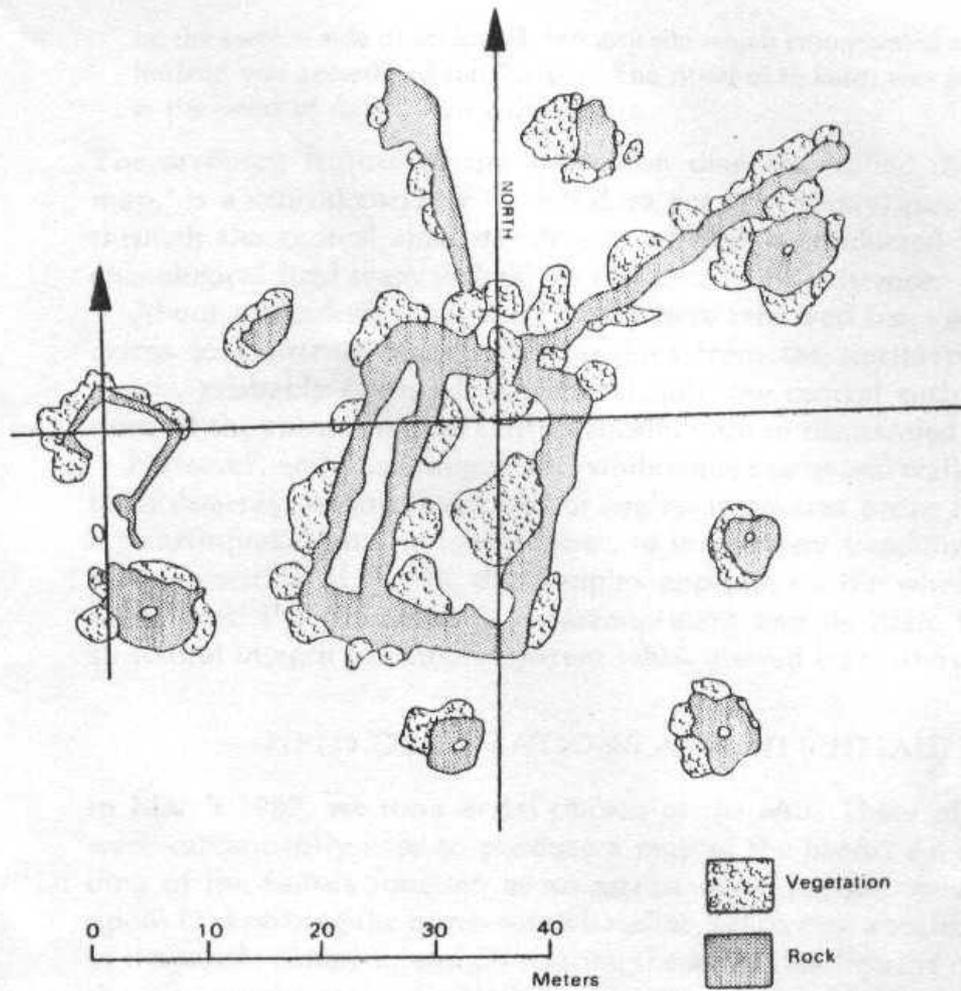


FIGURE 2. A directional and scaled baseline map of the Ahu a 'Umi Heiau complex.

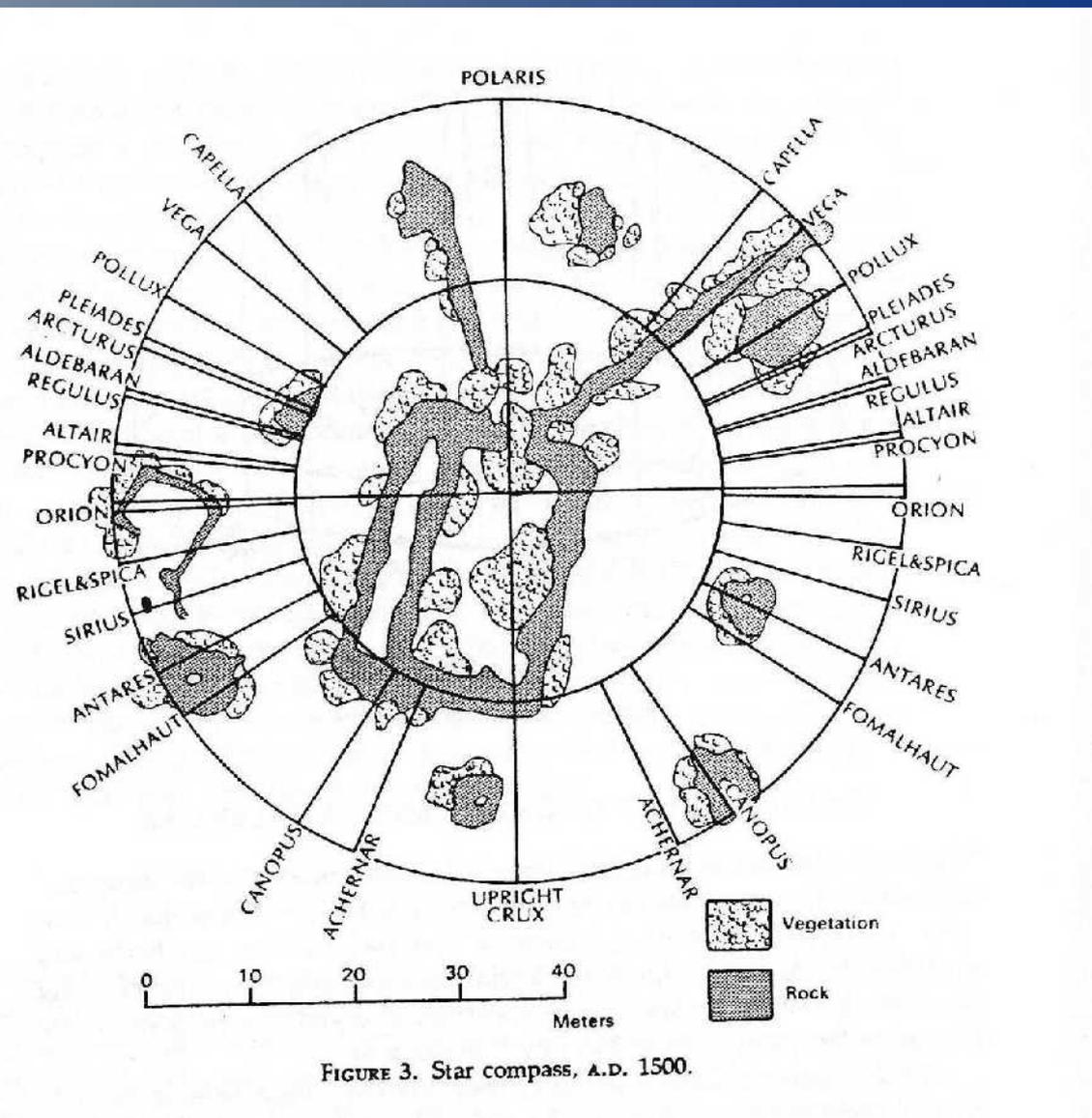


FIGURE 3. Star compass, A.D. 1500.

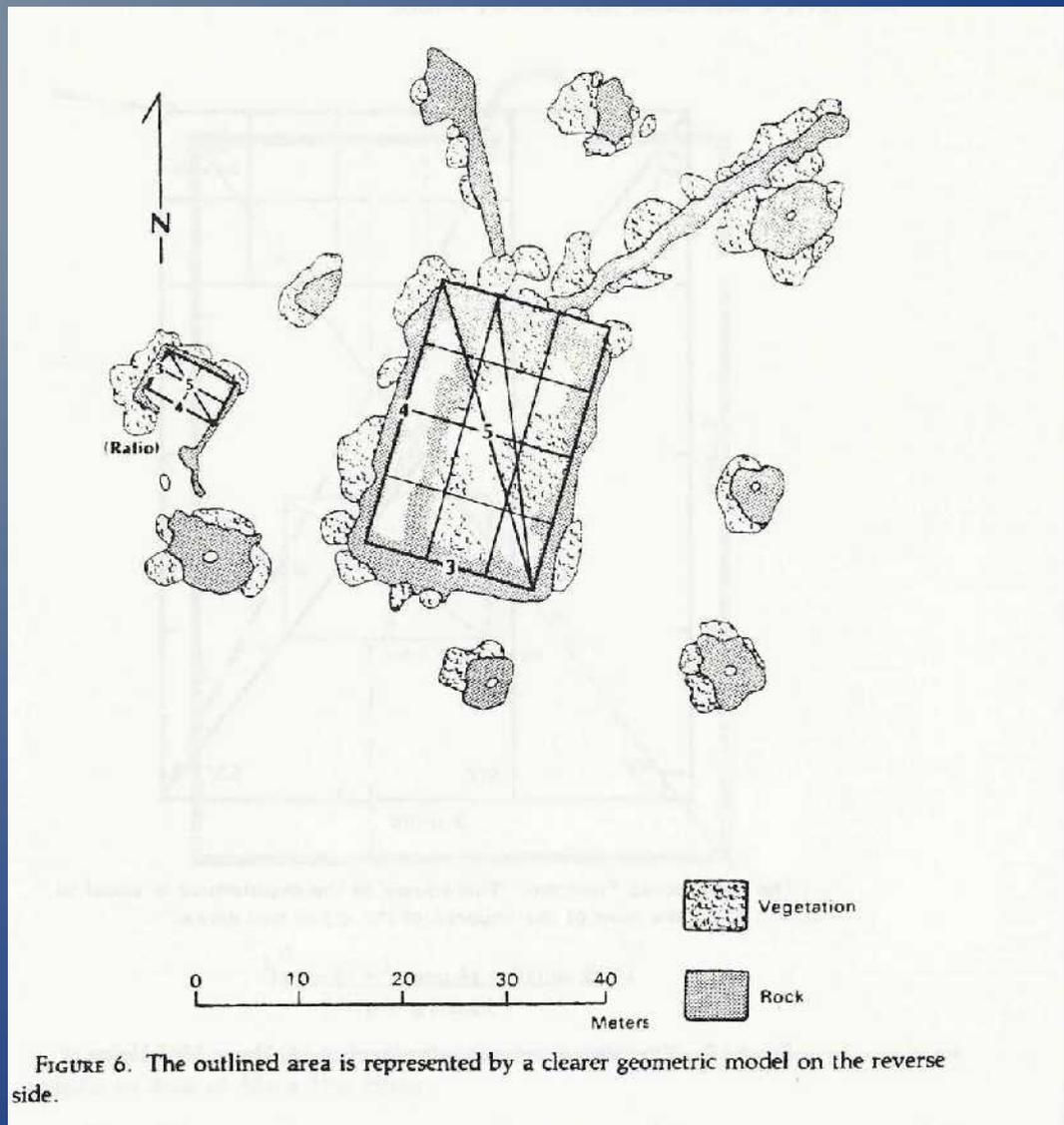


FIGURE 6. The outlined area is represented by a clearer geometric model on the reverse side.

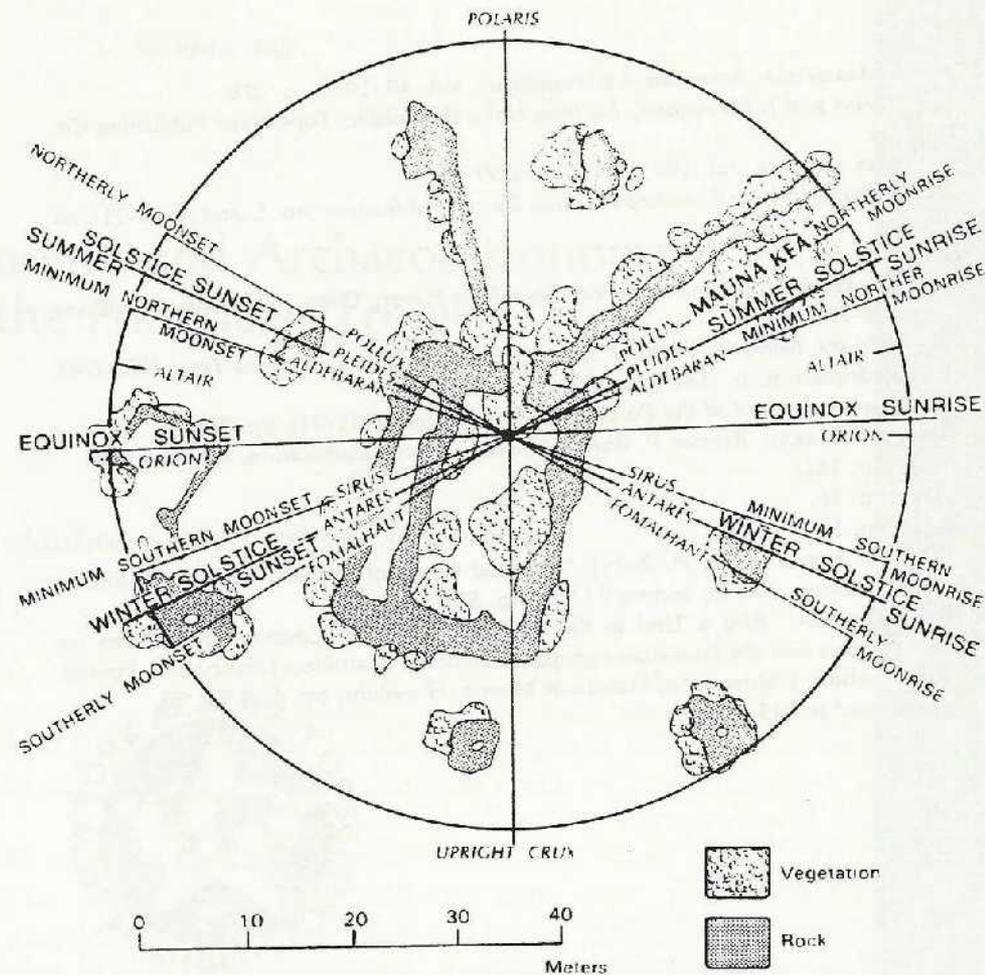


FIGURE 11. Solar-lunar-stellar associations.

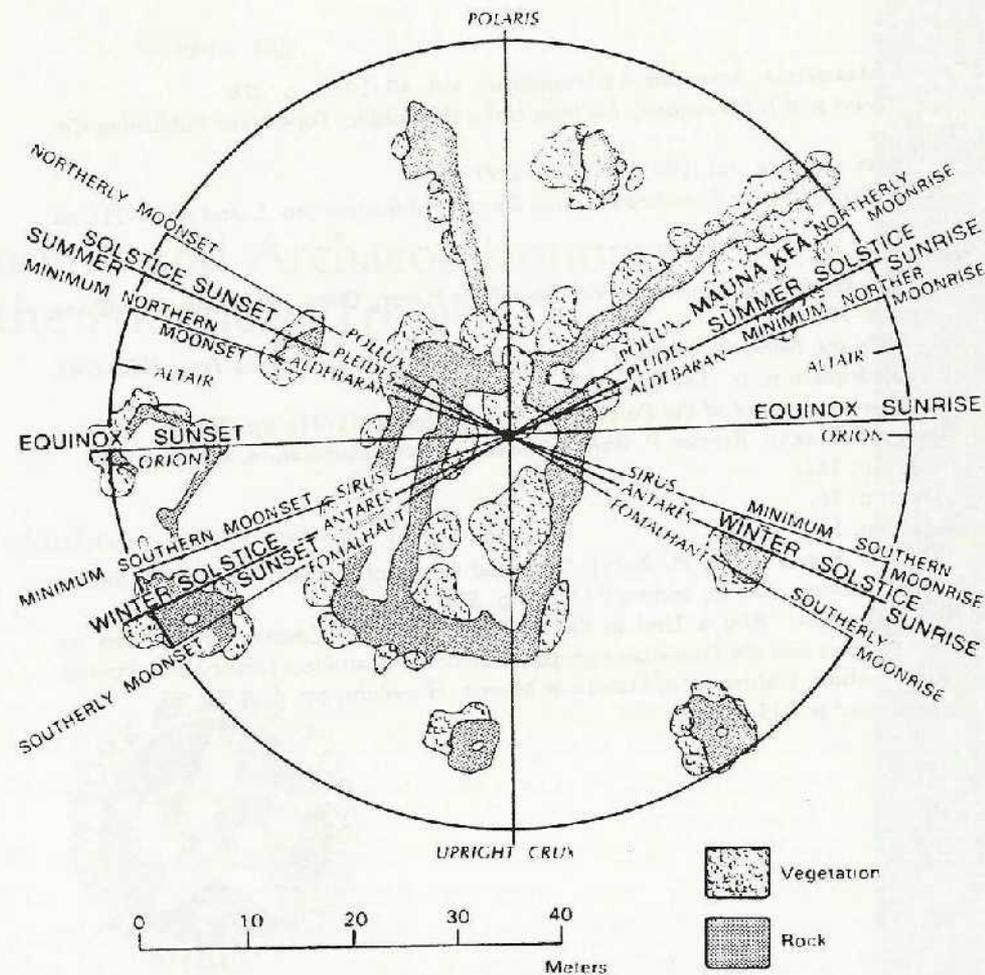


FIGURE 11. Solar-lunar-stellar associations.









Ni'ihau
Kaua'i

O'ahu

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Kaho'olawe

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Hawai'i



Kükaniloko















