Letter to the Editor:

The Murray Farm tunnel is reported as a horizontal corridor, partially cut into bedrock, with a cylindrical chamber at its end [1]. It has some interesting similarities to early Mediterranean megalithic tombs, comprising a long corridor and a round central chamber. In his book on the on the orientation of some 1000 southern European tombs built in the period from early Neolithic to Bronze age, Michael Hoskin, professor of the history of science at Cambridge University in England, finds that most of the communal tombs in southern Spain face toward the sun as it rises or as it ascends [2]. However there are small regions where other customs prevailed, from which a set of north-facing tombs can be taken, as listed in Table 1.

One of these is at the town of Valencina de la Concepcion. "In the third millennium, when it was close to the sea, Valencina was the site of a vast settlement, a number of whose tombs survived into modern times." One of those cherished by the city fathers and named Matarubilla is a corridor-type tomb with a tholos chamber at its end containing a central table. The book has a photograph which shows a remarkable straight flat-walled corridor 37 meters long, 140 cm wide at the base and 130 cm wide at its top, bearing a marked similarity to the photo of the Murray tunnel taken in 1981. The other tomb named La Pastora has a 44 meter corridor 1.5 meters in height "and there are three successive portals, each with a lintel and side pillars that protrude from the walls".

Hoskin suggests that these corridors have ancient stellar associations. The first at azimuth 18 degrees fits the rising of the bring star Arcturus in 3150 +- 50 BC, and the other at 243 degrees the setting of Sirius in 2250 +- 50 BC. These assignments make sense in the light of his study of the temples at Mjandra on Malta, built in the local "Tarxien" phase of 3000-2500 BC, in the same time period. Although most of the Malta structures faced towards the south, where they could see the trajectory of Centaurus or the Southern Cross around 3000 BC, Hoskin argued that Mjandra I faced the rising of the Pleiades, and that Mjandra III had a calendar tally stone showing the annual first appearance (heliacal rising) of 11 stars on the horizon, among them the Pleiades, Sirus and Arcturus. He surmises that Hesiod's poem "Works and Days" recounts earlier wisdom as it mentions when "rosy-fingered dawn gazes on Arcturus", and when "the Pleiades and the Hyades and the might of Orion set" at the end of the farmer's year.

In addition to Valencina, Hoskin singles out some other megalithic tombs on the basis of their northerly orientation. In the town of Almaden de la Plata, close to Valencina, he and his local collaborators found the remains of a dolmen with orientation 32 degrees.

In the interior region of Bajadoz a tomb named Monasterio has azimuth 26 degrees. In this area many other tomb orientations were not solar, with possibilities for north lunar major rise and Pleiades rise, and iron mines are mentioned.

Another region with a tomb called Los Charcones oriented at 32 degrees was at the very southern tip of Spain in Cadiz, west of Gibraltar. The other tombs in this region were also anomalous, with orientations only to the southwest, and azimuths that are candidates for southern lunar major and minor set or descent. They had "galleries", only a meter or so in width of up to 7 meters in length, with parallel sides consisting of rows of orthostats". One had an 80 degree bend, somewhat like the elbow-shaped tombs of southern France.

Although the structure of the Murray chamber is reported to have a barrel arch, not generally thought to be early, its orientation may be compared to these early structures. On the basis of compass measurements corrected for the local magnetic deviation from north, the Murray tunnel is reported to point 9 degrees east of true north (Az=9). The astronomical declination of the object it would view on

Table 1. Orientation of Spanish Corridor Tombs [2]

department	Sevilla	Sevilla	Sevilla	Sevilla	Bajadoj	Cadiz
town	Valencina de la Concepcion	Valencina de la Concepcion	Valencina de la Concepcion	Almaden de la Plata	Monasterio	benalup
name	Ontiveros	Matarubilia	La Pastora	Bradford	La Dehesa	Los Charcones
type	unexcavated	corridor	corridor	burned face	megalithic tomb	modest back & side stones
length (m)	long	37	44			
width (m)		2	1.5			
height (m)		1.4				
Azimuth (deg)		17d 48m	242d 57m	32	26	32
Elevation (deg)		0.6 to 1.1	1.8 to 2.0	8	1	1
Star		arcturus	Sirius	arcturus	arcturus	arcturus
Date (BC)		3150	2250	3000?	2500?	2900?
Error (years)		+_ 50	+_ 50			

a horizon with 2 degrees of elevation (h=2) can then be computed by using

$$\sin d = \sin (Az) \cos (h) + \sin (L) \sin (h)$$

(where L=42.5 degrees is the latitude of Greer OH), from which the declination d = 50 degrees results. As remarked by Moseley, many different stars can appear in this direction as the angle of the earth's axis precesses. He mentions stars on the circle of 23.5 degrees radius from the galactic pole which the earth's axis traces on the celestial sphere. However it is not only stars on this circle which matter. Wherever the earth's axis points, on any given night there is an arc composed of a circle of stars which passes through the observation direction during the hours of darkness.

Computation using the precession routine in "Easy PC Astronomy" [3] shows that the radius of this arc corresponded to d = 28 in 2500 BC and d = 25 in 3000 BC. These are similar to the declinations of 25 used by Hoskin for Archurus in 2500 BC and value 29 for Sirius on 3000 B. It is worth noting that at the latitude of Mesoamerica an azimuth of 9 degrees corresponds to an entirely different star.

It is interesting to speculate that there could be a common source for the Mediterranean and Ohio structures, accounting for the common ethnographic traits of construction of long rock-cut structures and observation of prominent star groups. Although there seems to have been an infusion of Libyan or

Iberian "prospector groups" into the New World after 800 BC, there is argued to be an earlier group around 2000 BC [4]. The later people, workers of copper, silver, and gold, first appeared on the Pacific coast of Mexico around 1500 BC, according to a dissertation by R.E.L. Chadwick [5]. They seem to have occupied intrusive guilds or special precincts within cities where they practiced their metalworking and lapidary trades. The growth of the skulls of their noble infants was constrained into tall deformed heads and other shapes. They had characteristic shoe-shaped and stirrup-handle shapes of potter, the former also being found on Mediterranean shores. The simultaneous occurrence of several unnecessary and unusual traits (metalworking, cranial deformation, trephination, and pottery) serves to rule out independent invention and show cultural transmission among some dozen intrusive sites over a period spanning 3500 years. Preservation for so long and so far implies an extremely conservative endogamous group, with rigid social distance from the local peasants. In Chadwick's synthesis, they possibly began as the Bell-Beaker people of Europe and North Africa, who dominated valuable mining regions and then departed, with their social practices giving rise to the myths of Quetzlcoatl.

It seems unlikely that Europeans arrived on the Pacific coast of Mexico; however the earlier group of prospectors could possibly have come from the Mediterranean. Perhaps they brought the trait of astronomically oriented tombs with them, a different trait than the shaft tombs as deep as 6 meters filled with rich grave goods that are associated with the later group of metal working miners. Although he discusses a spectacular group of seven long-corridor tombs facing southwest at Fontvielle on the Rhone in France, an interest in the northern sky is associated with other specific geographic areas accessible to sea-going prospectors in Hoskin's book. He records disruption of the majority custom of orientation towards sunrise at the southern end of Sardinia, where there are 8 anomalous tombs as early as 2400 BC with $0 < Az < 64$. This island had an international commerce, as shown by its export of obsidian to Spain and France during Neolithic and Chalcolithic times. His studies on the temples of the Island of Malta have already been mentioned, and he goes so far as to mention the sea peoples who hired their navy out to the Egyptians. The tombs listed in Table 1 might also be associated with a sea-going intrusive culture. The two long-corridor tombs are located at Valencina on the Mediterranean in Spain. If the prospector cultures mined iron, which has now rusted away, as well as copper, they might account for the northern tomb and the lunar possibilities in Bajadoz. This outpost away from the sea is served by the Guadiana, a major river towards the north from Cadiz and Sevilla. If the region in Cadiz near the straits of Gibraltar was one of the intrusive outposts of the "prospector culture" it might have remained an international colony for many years. The tombs with a possible orientation toward the setting moon could correspond to the internationally influenced third phase of Stonehenge after 1720 BC, when it has been argued that trade in copper, bronze and gold by overlords from Brittany caused its conversion from celebration of sunrise on the summer solstice to fear of loss of sun [6] and moon [7] at their furthest southwestern settings on the winter solstice.

A speculative astronomical hypothesis is interesting, but a single buried tunnel in Ohio does little to decrease its speculative nature. In the Southwest, the single original sun dagger and man-made target at Fajeda Butte, argued to have been made with astronomical intent, has been followed by multiple finds of sunbeams illuminating man-made targets, proving that such intent existed [8]. Possibly more north-facing corridors or shaft graves such as the one in Goshen MA near the Connecticut River [9, 10] will be found and reported in North America.

Sincerely yours

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