

## Arcturus and the Bears

E. Antonello

*INAF-Osservatorio Astronomico di Brera, Via E. Bianchi 46, 23807  
 Merate, Italy*

*SIA-Società Italiana di Archeoastronomia*

**Abstract.** Arcturus is the brightest star in Bootes. The ancient Greek name *Arktouros* means Bear Guard. The star, however, is not close to Ursa Maior (Big She-Bear) and Ursa Minor (Little She-Bear), as the name would suggest. This curious discrepancy could be explained by the star proper motion, assuming the name Bear Guard is a remote cultural heritage. The proper motion analysis could allow us to get an insight also into an ancient myth regarding Ursa Maior. Though we cannot explain scientifically such a myth, some interesting suggestions can be obtained about its possible origin, in the context of the present knowledge of the importance of the cult of the bear both during the Palaeolithic times and for several primitive populations of modern times, as shown by the ethnological studies.

### 1. Ursa Maior, Arcturus and proper motions

Ursa Maior could be one of the ‘oldest’ constellations. Probably it was identified during the Ice Age, before Asia and America were separated by the Bering Strait, as this sky She-Bear is a common cultural heritage among native populations of Europe, Asia and North America (see e.g. Gingerich 1984, Gurshtein 1993, Gurshtein 1995, Schaefer 2006; for different views, see Thompson 2008). Note that according to several myths, the Bear is represented by just the four stars of the ‘bowl’ of the Big Dipper.

The ancient Greek name of the bright star Arcturus (*Arktouros*) means Bear Guard; however the star is not close to Ursa Maior and Ursa Minor as the name would suggest.

Taking into account the measured proper motions and parallax (Hipparcos Catalogue, ESA) and the stellar radial velocity (Barbier-Fossat & Figon 2000), it is possible to represent the relative position of the stars in the past millennia. The precession is not considered, since the known precession models do not give reliable values for the very distant past. Here, however, we are not interested in the absolute but only in the relative position of the stars. The uncertainty in the predicted *relative* coordinatae is negligible for our purposes: it is less than few arcmin over 50000 years for most stars, and few tens arcmin for stars with large parallax and the largest error in radial velocity. We do not consider pathological cases (nearby visual double stars with similar components).

As an example, the sky of 32000 BC is compared with the present day sky in Fig. 1; it is possible to see that in the past Arcturus was closer to Ursa Maior than today.

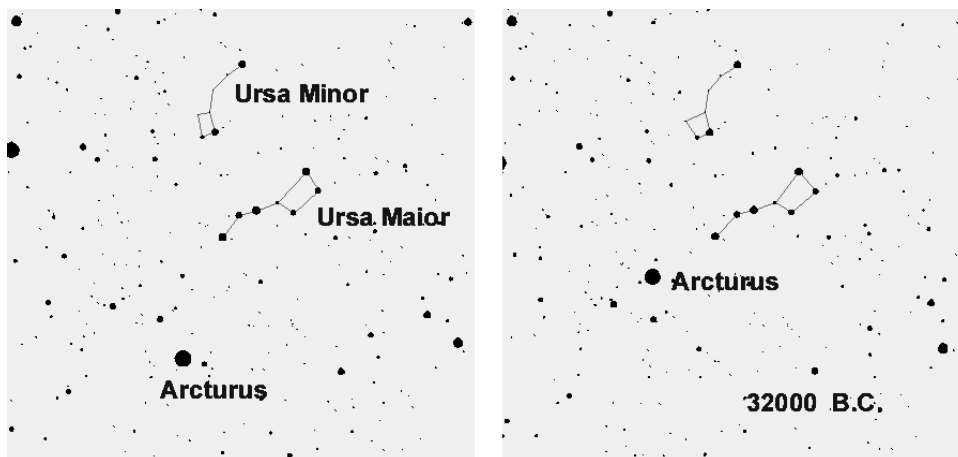


Figure 1. The present day Ursa Minor, Ursa Maior and Arcturus (left panel) compared with the sky of 32000 BC (right panel).

## 2. Ancient myths, anthropology and proper motions

Callisto (or Kallisto) was a daughter of Lykaon, king of Arcadia, and a hunting companion of the goddess Artemis (Diana). There exist several versions of the story. According to Ovidius (see *Metamorphoses*), Zeus (Jupiter) seduced Callisto, and she gave birth to Arcas. Zeus's wife Hera (Juno) saw this evidence of his infidelity and she changed Callisto into a bear. When Arcas was a young man, he went into the woods for hunting, and came where this bear lived. Callisto recognized her son and came upon him. Arcas, however, did not recognize his mother and tried to defend himself. Zeus intervened and placed Callisto in the heavens as the Ursa Maior constellation, and Arcas as another constellation. In *Fasti* (2, 155), Ovidius says that the second constellation was Arctophylax (bear 'keeper' or 'driver'; Bootes), but in *Fasti* (6, 235) Arctophylax is probably referred to Lykaon.

Hera asked Ocean, the river that surrounds the earth, not to permit her 'rival' Ursa Maior to wash itself in his waters; therefore, the constellation never drops into the ocean. This final part of the myth, however, cannot be much older than ancient Greeks, owing to the precession effect.

More than 50000 years ago Arcturus was located near to the Bears. That time, however, the shape of the two constellations was different from that of historical times. The bowl of the 'Big Dipper' was a pentagon: the star  $\theta$  UMa was one of the vertices along with  $\alpha$ ,  $\beta$ ,  $\gamma$  and  $\delta$  UMa. Moreover Ursa Minor stars could be interpreted in a different way (Fig. 2). The two constellations could be interpreted as the opposition of a hunter and a standing bear. If this picture is plausible, the clou in the ancient myth, that is the hunter (Arcas) against the bear (Callisto), could get a cosmic meaning if referred to the sky of some ten thousand years ago. Gurshtein (1995) reports that according to anthropologists "a bear cult and the first bear ritual burial are not younger than 50 thousand years" (see also Frank 1996); may be "that under the matriarchal condition,

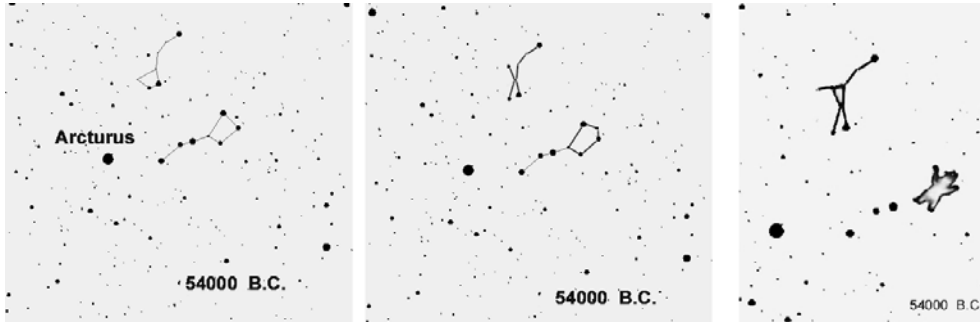


Figure 2. The shape of the constellations on 54000 BC and an hypothetical interpretation.

she-bears had to appear on the sky as the taboo totem of the cave dwellers". Note that several native populations in Northern Hemisphere consider the bear very important, it is an ancestor and a relative.

### 3. Conclusion

The present results regarding Arcturus appear to support the hypothesis of the primitiveness of the Ursa Maior constellation. Moreover, the discussion of the stellar proper motions suggests a possible interpretation of the clou of the myth (just a 'flash'), conveyed through Greek mythology.

Some caveats are in order: 1) there are very different versions of the Greek myth of Callisto, indicating different 'strata' and sources; 2) as it is quite often the case in this research field, our suggestion is just a hint and cannot be proven.

It is not possible to understand and explain scientifically the ancient myths, owing to the rendering into unknown languages by many different people and the transfer through many generations. It is possible however to have an insight of and appreciate such myths if we adopt an appropriate mentality, and see them as remake movies, in which men retold the stories according to their different views but preserved a remote (though by then unintelligible) core. The methods of science are essential for such an appreciation.

### References

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