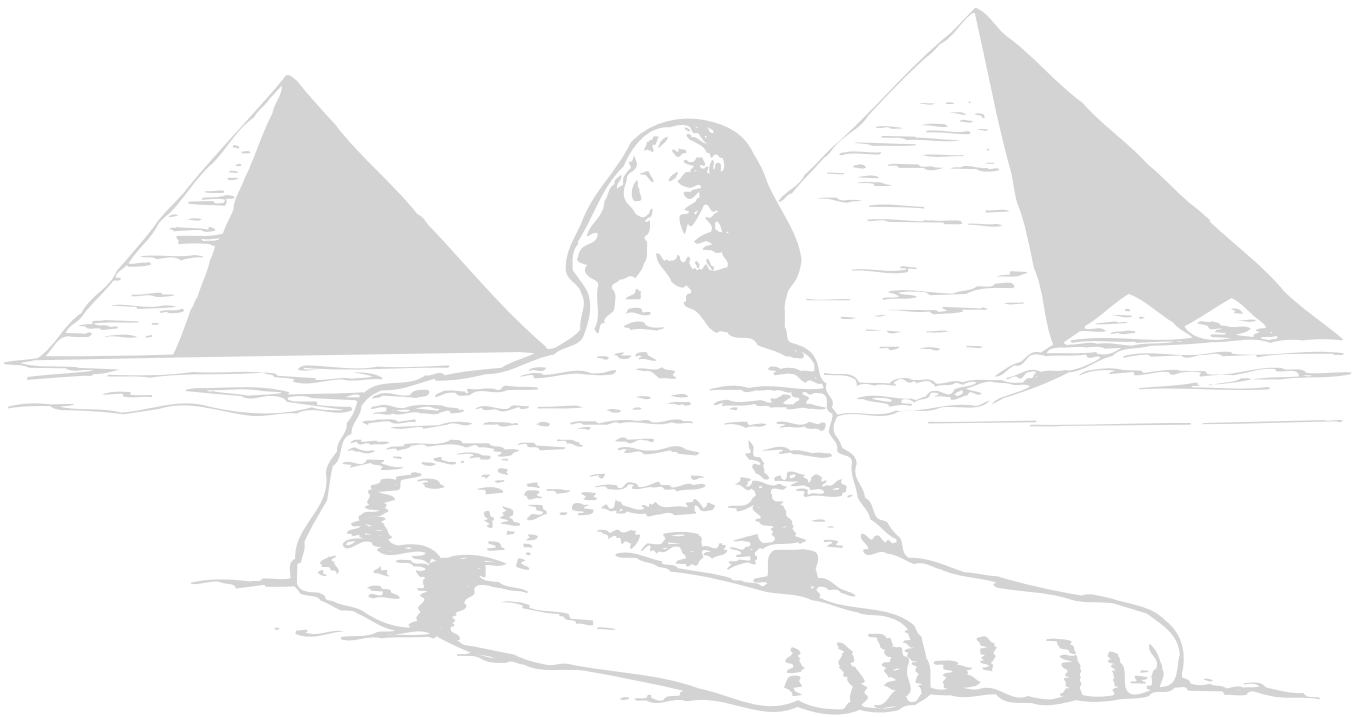




**A Collection of Curricula  
for the STARLAB®  
Ancient Egyptian Cylinder**



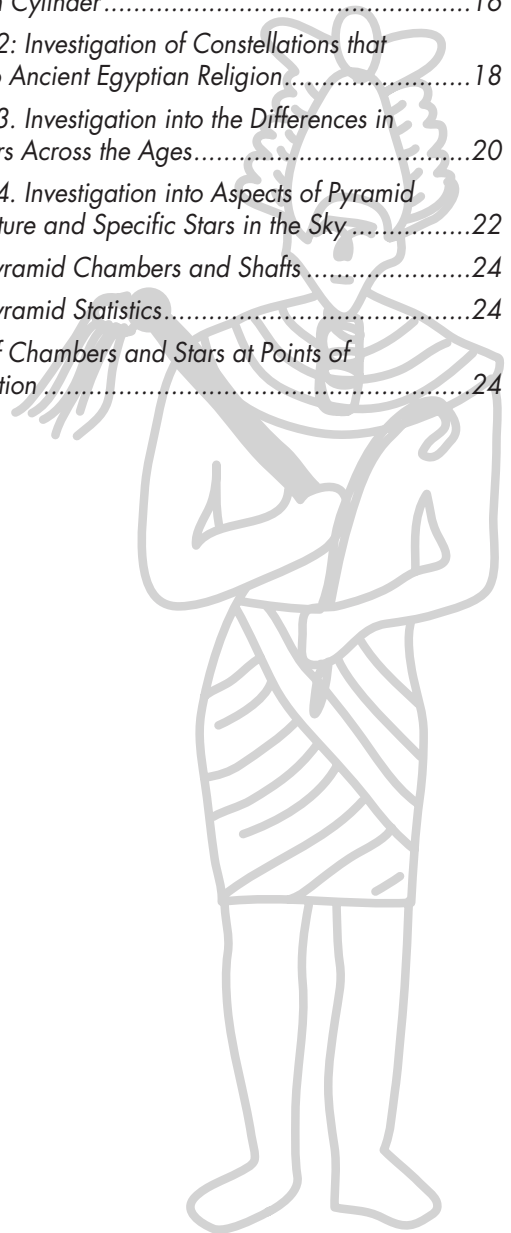
Including:

*Ancient Egyptian Culture and the Stars by  
Murray R. Barber F.R.A.S.*



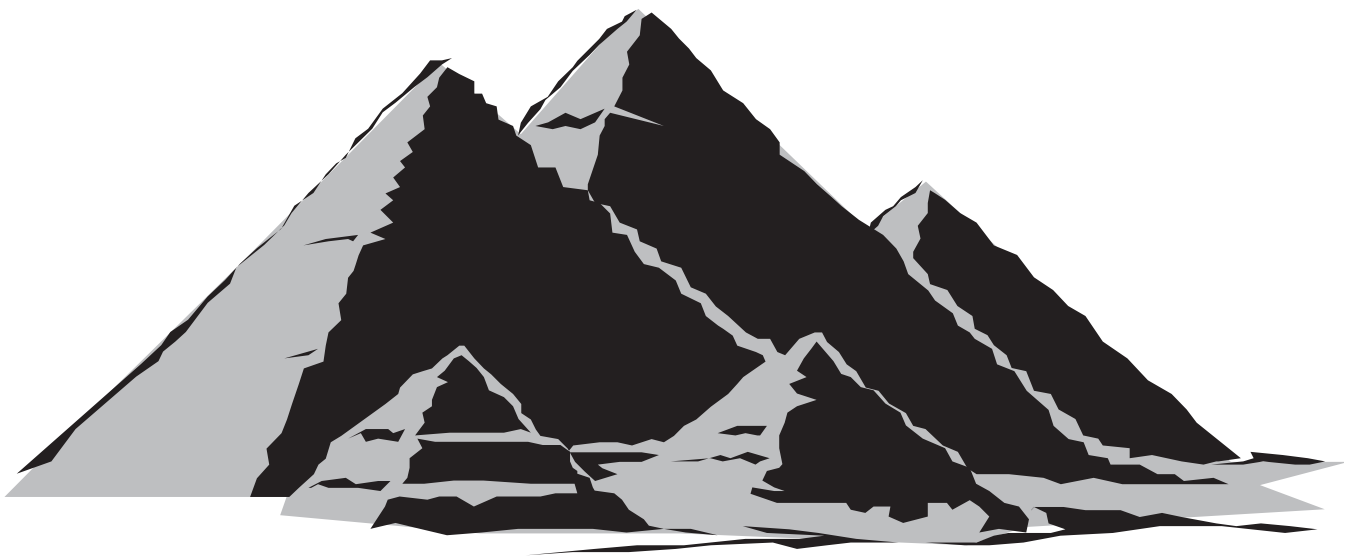
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**Ancient Egyptian Culture  
and the Stars**

*Cylinder and  
curriculum  
contributed  
by Murray  
R. Barber  
F.R.A.S*



## General Introduction

For the Ancient Egyptians, the sun, moon, planets, stars and star patterns were of great significance not only for timekeeping and use in surveying but also because these objects could be directly linked to the gods and goddesses that were worshipped and feared. Patterns and individual stars in the sky would again represent not only the deities but also Pharaohs and more common 'day to day' objects with which ordinary Egyptians could associate. These patterns, called constellations, are symbols of important aspects of daily, political and religious life.

The Ancient Egyptians believed that the sun was of extreme importance and that as a deity would change its character throughout the day. Additionally, the Ancient Egyptians did not take for granted that the sun would rise in the morning. Its rising would only be granted if the gods were appeased.

A large number of these Ancient Egyptian constellations, are related to an important myth often called 'The Tragedy of Osiris.' The myth is a classic tale of conspiracy and treachery that led to the first death on Earth. In the subsequent power struggle, good is ultimately triumphant over evil. This myth is detailed on page 6.

The Ancient Egyptian Cylinder represents a period of time from 3000 BC up to the birth of Christ. During this enormous time span, deities would fall and rise in importance given cultural and political changes in Egypt. The power of the Pharaohs would lead to the building of extraordinary buildings and funeral sites. These elements can be seen in the cylinder which shows thirty-six different constellations in their correct positions in the sky.

Additionally, the effect of a phenomenon called 'The Precession of the Equinoxes' can be seen. This effect causes the North Celestial Pole to travel a large circular pathway across the sky every 25,800 years. The North Pole Star today is Polaris, but Polaris was not the North Pole Star when the pyramids were built. The Ancient Egyptian Cylinder shows the North Pole Star as it was in 2500 BC. It was a seemingly insignificant star called Thuban in the constellation that the Greeks called Draco.

The history of the Ancient Egyptian culture gives us a very near complete picture of the past, but in some instances confusion exists as important elements of this historical image are confusing or lost. In more recent times, very different interpretations have been given regarding, in particular, the pyramids.

The origin for most of the constellations is well documented but for a few of these patterns, their background is not fully understood and lost in the 'mists of time.' In such instances, it is interesting to speculate the meaning of these misunderstood constellations.

The twelve familiar Greek constellation of the zodiac can be traced back to the Ancient Egyptians. It is these patterns that the sun appears to travel through as the Earth orbits once a year. Most of these constellations are immediately apparent but a few represented on the Ancient Egyptian Cylinder seem odd to our modern eyes.

## **A Brief History of Ancient Egypt**

There are three basic reasons that were to make the Ancient Egyptians historically important. Firstly, upper and lower Egypt were united by powerful Pharaohs thus producing a single nation. Secondly, the Ancient Egyptians developed agriculture and irrigation which ensured frequent bountiful harvests. This simultaneously, however, led to conflicts with other nations envious of their success and the rich lands either side of the Nile. Thirdly, the Nile itself. The importance of the Nile can not be under estimated. The Nile and its three-month long flood brought nutrient rich silt onto the flood plains. Additionally, the Nile was and is a means of navigable transportation.

The great interest today in the Ancient Egyptians stems from the extraordinary artifacts left behind by them and the chance discovery of the means of translating the hieroglyphic writing.

Artifacts, be they tiny gold flies given as medals to brave soldiers or the colossal Pyramids of Giza, show designs of artistry and technologies that even today in many instances are difficult to repeat. The common perception of the Ancient Egyptians is their fascination in death due to the remarkable preservation of mummies but the study of Ancient Egypt has far more to offer than funeral rites.

In 1799 at Rossette in the western Delta, a chance discovery of an engraved stone by a French soldier led ultimately to the deciphering of hieroglyphics. The face of the stone contained three different texts, including Greek and hieroglyphs. This, the famous Rossetta Stone, was examined by Jean-Francois Champollion who over a period of many years translated the hieroglyphs (meaning sacred writings) into French. By 1833, a full translation existed. Previously, these texts which cover ancient monuments and other relics were a mystery, but practically overnight, whole histories of the Pharaohs and the religious beliefs of thousands of years emerged.

Ancient Egyptian history is divided into dynasties. From the time of Christ and going back to 4777 BC the basic dynasties are Ptolemaic Period, Persian Period, Late Period, New Kingdom, Middle Kingdom, First Intermediate Period, Old Kingdom and Proto Dynastic Period. The Pyramids were built, it is believed, during the Old Kingdom Period, 3998 - 2750 BC approximately.

### **Religion**

Ancient Egyptian faith consisted of myths, nature worship and numerous gods and goddesses. The naming of deities often shows inconsistencies and contradictions, but frequently they would be popular in one area or city but not necessarily across the whole country. Gods and goddesses would often be represented with human bodies but with animal heads. A bird or an animal could often be linked to a deity — as an example, a jackal would be linked to the god Anubis. Pharaohs as supreme rulers were considered to be gods in life and gods eternal in death.

The first god was Nu, god of the waters and he created Ra the sun god who was more powerful than Nu. Ra created Seb the earth god and Nut the goddess of the firmament. Their children were Osiris, Isis, Set and Nephthys.

The 'Tragedy of Osiris' myth helps us to understand the many aspects of the funeral rites that were practiced by the Egyptians. Osiris, as the first person to die, could only enjoy eternal life in the afterworld if his body was prepared in a specific manner. All subsequent funeral rites practiced by High Priest upon Pharaohs and others of high rank is an imitation of this. Even the casket made by Set is reproduced as a sarcophagus.

The ancient Egyptians believed that a person had six 'souls.' Each served a different function. A living person's shadow was part of this multiple soul faith. The Ka spirit was believed to stay on Earth and the Ba spirit went to heaven. The priesthood would attend to the funeral rites and also care for the Ka spirit. The priests would perform the religious ceremonies to ensure and guarantee the rising of the sun each day. Important religious sites can be found at Karnac and Luxor.

### **The Pyramids**

The Pharaohs of the First Kingdom commissioned the pyramids and often they were built by agricultural workers during the three-month flood period. These colossal structures could contain over 2.3 million limestone blocks, ranging in weight from 2.5 to 15 long tons (1 long ton = 2240 pounds), and would take about 20 years to complete.

Early pyramids during the Proto-Dynastic Period are clearly experimental in the pioneering of both masonry and also in the logistics of moving stones great distances across both land and water from the Aswan quarries. Zoser's Pyramid was a step pyramid. Snofru's Pyramid is bent and shorter than the original design due to the anxiety the builders had of the summit shearing away.

It is, however, the Great Pyramids of Giza that continue to capture mankind's imagination. The Great Pyramid (Cheops) was built by Khufu. His son, Khafé (Chephren) built the second. The third pyramid was built by his son Menkawre (Mycerinus) who also built additional smaller pyramids at Giza. The pyramids can be thought of as tombs, cathedrals and possibly observatories. Modern Egyptologists believe that pyramidal shafts may have been used in religious ceremonies to aid the ascension of the spirit to the heavens. Four stars in the sky, of special importance to the Egyptians, appear to be in direct alignment with these shafts.

Unfortunately, the pyramids of Egypt have stood empty for many millenniums due to attacks by grave robbers. The mummified bodies were torn apart by robbers seeking valuable amulets that would be hidden in the bandaging. Because the tombs were furnished with luxuries to keep the Ka spirit content, the tombs were violated in spite of curses and priestly guards.

Due to the activities of the grave robbers and the great cost of constructing pyramids, the ancient Egyptians developed the 'Valley of the Kings' to safeguard subsequent burials. Even here however, the grave robbers soon plundered all but a few tombs.

One tomb that escaped the full ravishes of thefts was Tutankhamen whose near unviolated tomb was discovered by Carter and Carnarvon in 1922.

### **The Tragedy of Osiris**

When the god Ra became aged, he ascended into heaven and his place was taken by Osiris who ruled the world with his wife Isis. Their child was the baby boy, Horus. In those days, people were but savages and without law and order. Osiris established his authority and ruled the lands with compassion and understanding. He taught the people how to cultivate the land and to harvest the wheat. Isis showed the people how to grind flour and make bread. Osiris encouraged his people to settle arguments by reasoned conversation and so Egypt flourished without war and strife.

In the royal household, Set, the brother of Osiris, was envious and schemed to take power for himself. Set longed for war and to end the peace that existed. While Osiris was visiting the outer frontiers of the land, Set had the finest craftsmen build a beautiful casket, the dimension of which fitted perfectly the shape of Osiris. The casket and heavy lid gleamed with semi-precious stones, silver and gold. Everyone marvelled on seeing it. Osiris returned from his journey and the people cheered him. Set invited Osiris to a celebration feast and afterwards, Set ordered that the casket

be brought out. Everyone gasped at its beauty. Set then said, 'who ever fits perfectly the casket, will own it!' One by one the guests tried it but no one quite fitted. Osiris joined in the merriment and lowered himself in. He smiled at Set and said 'it fits me perfectly' at which Set and the fellow armed traitors rushed forward, slammed down the lid and nailed it shut. And so ended the reign of Osiris.

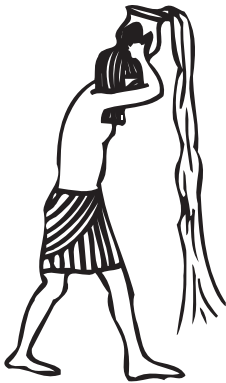
Set and the traitors dragged the casket to the Nile and threw it in. A terrible darkness covered the lands. With no power to stop him, Set ruled with an iron fist and destroyed those loyal to Osiris. Without mercy, he ordered the peoples of the land to wage war against peaceful nations. Isis, in hiding, wept for Osiris and her tears caused the first flood of the Nile. While Isis secretly searched for the casket, Set conjured magical creatures to constantly chase after her, including a jackal and a sea monster called Typhon. Her only protection were seven scorpions who had been sent by the goddess Selket to keep her from harm. Isis searched for a long time until eventually she was told by children that a casket had been washed ashore on the coast of Phoenicia. A huge tree had sprung up upon the beach and inside the tree was the casket.

Isis found the tree, cut it down and decided to return to Egypt with the casket loaded into a boat. As she was returning back home, she rested in a wooded clearing. During the night as she slept, Set, who had been hunting, came upon the casket. He ripped the lid off, took out his sword and chopped the body into pieces. He took the pieces to the Nile and threw them away. He did not want Osiris to have a proper burial so that his soul could go to heaven. Isis awoke too late to stop Set. She searched up and down the Nile until at last she had found as many body parts as she could.

The parts were put back together again and held in place by long lengths of bandages that wrapped around Osiris's body. Isis performed the funeral for Osiris so he could join Ra in heaven. Isis went into hiding and secretly brought up her son, young Horus, to be a brave warrior. One night in a dream, Osiris appeared before Horus and urged him to avenge his death. Horus called out to the peoples of Egypt that the time had come to battle Set and his armies. The people who were loyal to his father, joined Horus in a war that ravaged the country until, after many battles, Set and Horus met face to face.

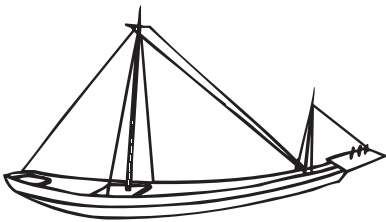
Set was by far the more experienced warrior and during the fight, his sword took out Horus's eye. Horus, although injured, had more energy than his older uncle and struck Set with his mace. Set's skull cracked and he was killed. Thoth descended from heaven and restored sight to Horus (hence the magical properties of the 'Wedjat Eye'). Set was given a traitor's burial. The people of Egypt rejoiced and celebrated the great triumph of good over evil. Never had there been such happiness in the land as Isis and Horus took the crown. When evil Set's spirit ascended into heaven, Ra in the presence of Osiris banished him to eternal hell.

## The Egyptian Constellations and the Greek Counterparts



### Aquarius (Khnum)

The Water Carrier and one of the creator gods. Khnum, a ram-headed god of the waters, the divine potter responsible with the god Hapy for the flood of the Nile. All the rivers of the Earth flow from his pot. The image, close to the Pictian fish, is one of two representations of Khnum. A constellation of the zodiac.



### Argo (Ark)

Boat. This is the boat that carried Osiris and Isis to safety during the great flood that Ra used to cleanse the world.



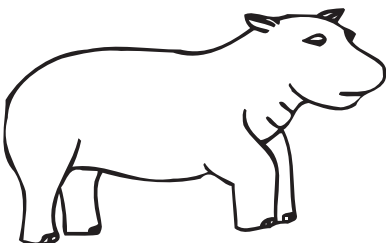
### Aries (Amommon)

With Ram horns. Initially an insignificant goose deity of Thebes but was later to become a ram-like figure and 'Supreme god of gods' and was linked with the worship of the sun. He cared for both the Pharaohs and the poor. He was the giver of victories. The great temple site of Karnak is dedicated to him. The outspread arms depicted, show the god's power extending beyond his body. A constellation of the zodiac.



### Auriga (Ptah)

God of pure intellect, inventor of the arts and yet another creator god. God of Memphis. Depicted as a bearded, bare-headed man whose lower limbs are wrapped in the garments of the mummy. He holds in his hand a mummified cat which is a reference to the reverence of both cats and lions.



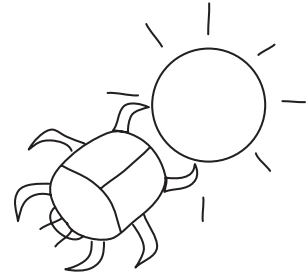
### Bootes (Hippopotamus)

As a female deity, this creature makes its rounds across the sky keeping a perpetual guarding eye upon the circumpolar stars associated with Set, especially 'Thigh and Jackal of Set.' This benevolent figure stops them from doing harm. This constellation may well be linked to Ta-urt, goddess of pregnancy and childbirth.



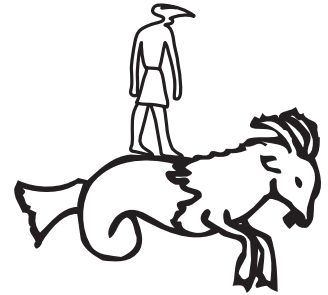
### Cancer (Scarab Beetle)

It was believed that the god Khepri in the form of a scarab beetle rolled the sun across the sky. This was an imitation of the scarab beetle rolling dung! The ancient Egyptians did not realise that the sun's daily motion was due to the Earth rotating upon its axis every 24 hours. The scarab was a sacred immortality symbol. A constellation of the zodiac.



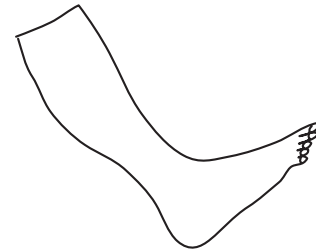
### Capricorn (Ibis-headed Man Riding a Sea Goat)

Origin unknown but may be related to either Isis or Thoth. A constellation of the zodiac.



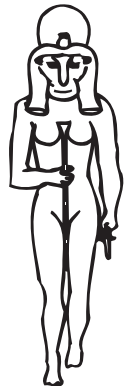
### Cassiopeia (Leg of Set)

See notes regarding 'Ursa Major.'



### Centaurus (Serk-t or possibly Sekhmet the Destroyer)

The goddess, wife of Ptah is the protector of the dead and often seen in funeral art.



### Cepheus (Khufu)

Builder of the Great Pyramid of Giza, often called 'Cheops Pyramid.' As an important Pharaoh of the Old Kingdom, he shut the temples and forbid the priests from making sacrifices. This had a poor effect upon the priests' livelihood and as a result, Khufu was despised and hated. It is likely however that the people of Egypt saw him as a great benefactor for they were regularly employed to work on the construction of the Great Pyramid at the time of the annual three-month long flood period when the farm lands were unworkable.



### Circumpolar Stars

These stars had different meanings dependent upon the beliefs and customs of the age. Three interpretations are given.

(Swallows): These birds fed upon the mythical fruit of the 'Tree of Immortality' that



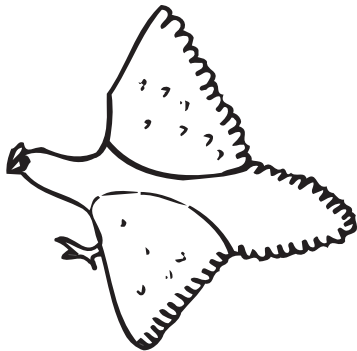
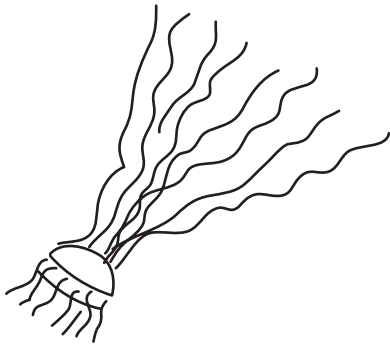
grew on an island in the middle of the 'Lake of the Green Falcon.' Because they never grew tired or died, they could be seen every night. The Pharaohs would hope that part of their souls would join these stars.

(Oarsman of Ship of Ra): As these stars do not set, they were sometimes called the 'Imperishable Ones' or the 'Never Vanishing' and hence became connected with being the 'Oarsman of Ship of Ra.' They row the sun across the wide blue river of the sky.

(72 Conspirator Stars): These stars remind us of the treachery of Set and his accomplices in the downfall of Osiris.

#### **Coma Berenices (Queen Berenice's Hair)**

The following account may have a basis in truth. Pharaoh Ptolemy III, a Greek ruler of the Ptolemaic Period, undertook a dangerous campaign against the Assyrians. His queen, Berenice was famed for her beautiful hair. She cut off her locks and presented them to the temple as a gift to the gods to safeguard the return of her husband. As soon as she had left the temple, the hair was stolen. The Pharaoh returned in triumph, but was horrified to see his wife minus her hair. When told of the offering, he announced that he would immediately visit the temple to pay homage. When he discovered the hair was stolen from the altar, he became furious and threatened to put the priests and attendants to the sword. But a priest cried out that the hair had not been stolen but had been taken by the gods and placed in the sky. Ptolemy was taken to a window and the star cluster which bears the queens name was pointed out. The Pharaoh, now satisfied and filled with delight, resheathed his sword. The priests and attendants breathed a sigh of relief for the true thief was never discovered!

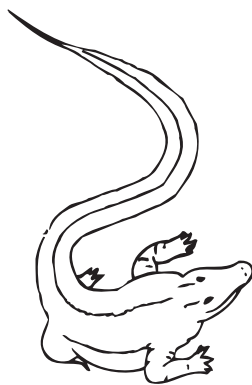


#### **Cygnus (The Hen in Flight)**

Origin unknown but possibly associated with festival feasts. Meat was a luxury and was only eaten on special occasions.

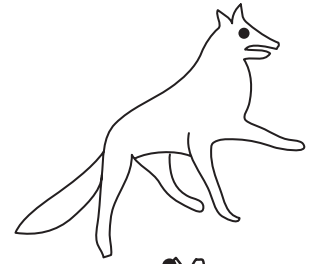
#### **Draco (Crocodile)**

This animal was worshipped as the Sebek (or Sobek). Crocodiles are often thought of as protectors of Egypt for they would deter enemies from swimming the Nile. For the common people of Egypt, the cost of ornate burials was beyond their means. The bodies of the poor were released into the Nile where the sacred crocodile would attend to the completion of the funeral rites. Around 2500 BC, the star Thuban in the tail of the crocodile was the North Pole Star. This differs from today's North Pole Star, Polaris and is due to an effect called the 'precession of the equinoxes.' This effect is similar to a child's 'spinning top' slowing down. As it does so, the axis 'wobbles.' As the Earth's axis wobbles, the North Celestial Pole slowly appears to move across the sky. This effect is normally unnoticeable during a human lifetime because the duration of one complete circular wobble is 25,800 years! A shaft in the Great Pyramid of Giza is said to have aligned with Thuban and may have taken part in the ceremony of the Pharaohs souls ascending into Heaven.



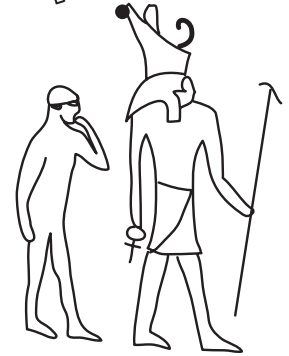
### Fox

Northern border of Scorpion and Ophiuchus. Origin unknown.



### Gemini (Horus the Elder and Younger)

Horus the Younger was the son of Osiris and Isis. As Horus the Elder, he avenged his father's death by the hand of his Uncle Set and became the archetypal Pharaoh. Horus is often depicted as a falcon or falcon-headed man. A constellation of the zodiac.



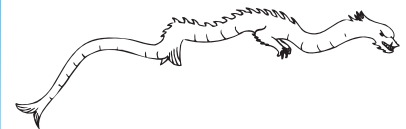
### Great Dog (Anubis)

Anubis, the dog-headed god of the dead, guardian of the cemeteries and overseer of embalming. Anubis also monitors the Scales of Truth. The early morning rising of Sirius (the Dog Star) warned the farmers of Egypt of the imminent annual flood of the Nile. Because of this link with fertility, Sirius is often associated with Isis.



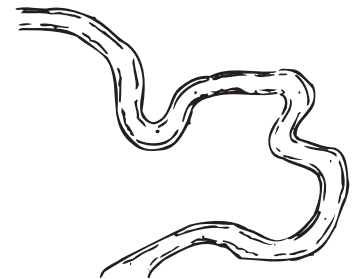
### Hydra (Typhon)

Typhon is an incarnation of Set and pursued Isis when she took to the Nile searching for Osiris.



### Iridanus (Nile)

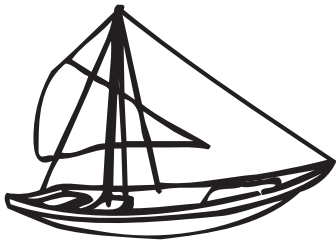
This pattern is symbolic of the all important Nile.



### Leo (Sphinx)

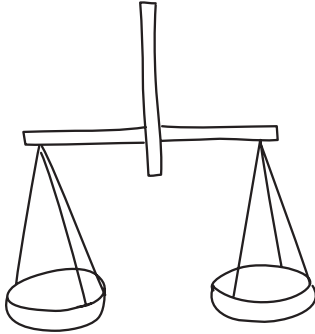
As a Sphinx (Egyptian for living image) it is associated with the stone Sphinx of Giza. With a depiction of Khafre's face, it guards the Khafre pyramid (sometimes called Chephren) and is a symbol of good. The constellation is also associated with draught as lions from the deserts would seek the cool waters of the Nile prior to the annual flood. This was a very dangerous event for the riverbank dwellers and coincided with the sun in this constellation. A tame lion mascot would often accompany the Pharaoh into battle. A constellation of the zodiac.





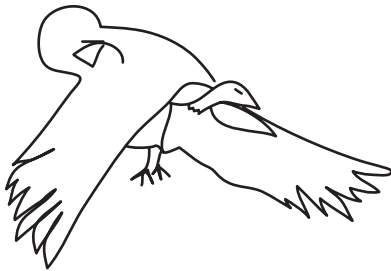
### **Lepus (Boat of Osiris)**

Origin unknown.



### **Libra (Scales of Truth)**

This represents the scales used to measure the integrity and worthiness of a person's heart to join the dead in eternal life. The jackal-headed god of death and embalming, Anubis weighs the heart against the weight of an ostrich's feather which represents truth. Thoth stands ready to scribe the results. If the scales balance, then the soul is ushered by Horus into the presence of Osiris and his consorts Isis and Nephthys for final judgement. If the heart fails the test, it is thrown to the multi-faceted monster, Ament, who devours it. A constellation of the zodiac.



### **Lyra (Vulture)**

Nekhebt, a goddess of the south. Its outspread wings offered protection to the king. Often seen in funeral art and in the crowns of pharaohs.



### **Milky Way**

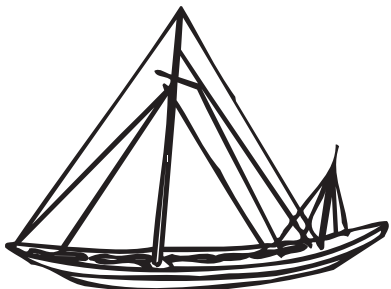
(Grains of Wheat)

Isis is often portrayed with a handful of wheat sheaves. During her adventure seeking Osiris and escaping Typhon, she dropped the sheaves and the grains of wheat scattered across the sky forming the Milky Way.



### **Orion (Osiris)**

Husband of Isis, deity of the dead and ruler of the Underworld. Osiris was the first living person to die. Belt stars are associated with the ascension of pharaohs' souls to heaven.



### **Pegasus (Sky Emblem of a Boat)**

At rest during the annual change of the Nile flow.

### Perseus (Khem)

The ancient Egyptian city of Letopolis was in earlier times called Khem. Khem was linked to these stars. The figure made by these stars may also have been linked to the ram-headed god Khnum, guardian of Khufu, the Great Pyramid builder. The image close to the Apis Bull is an early representation of Khnum.

### Pisces (The Fishes)

Origin unknown but this constellation features on the planisphere found in the Temple of Denderah. This planisphere of sandstone is nearly 5 feet in diameter and shows constellations that were popular with the ancient Egyptians around 700 B.C. A constellation of the zodiac.

### Pleiades

This star cluster is associated with the goddess Neith Protector of the dead, mistress of the ocean and goddess of war. The cluster is also linked to the cleansing and purifying 'flood' of Ra and three-day festival in memory of this mythical event. These stars are associated with the ascension of pharaohs souls and passageways in the pyramids. The cluster is seen down the back of the Apis Bull.

### Sagittarius (Ibis Swan)

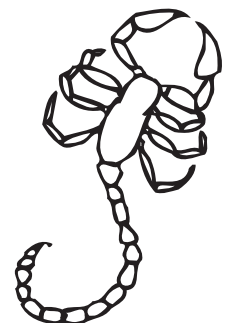
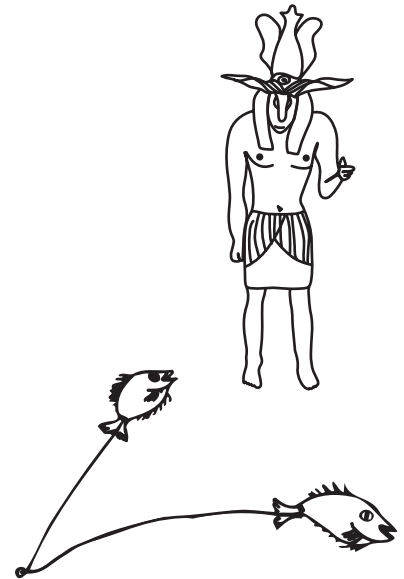
This creature was sacred to the Egyptians and is linked to the god of wisdom and inventor of hieroglyphs, Thoth. He is represented by an ibis or an ibis-headed man. The sacred Ibis, revered for its plumes has now become extinct. A constellation of the zodiac.

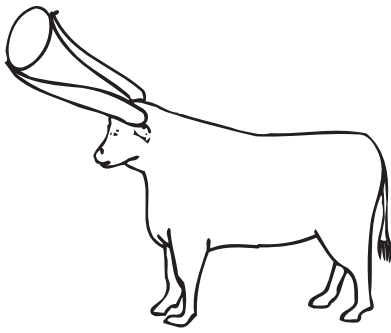
### Sagitta (An Obelisk)

These huge carved stone monuments have inscribed upon them in hieroglyphics, titles of Pharaohs and dedications to the gods. The tip of an obelisk represents the ground where Ra stood to create the universe.

### Scorpio

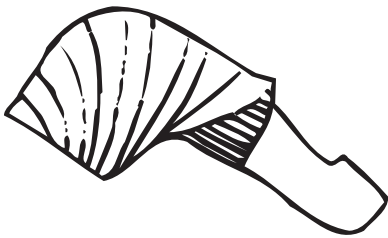
One of the seven scorpions that protected Isis as she searched for Osiris. Linked to Selket. A constellation of the zodiac.





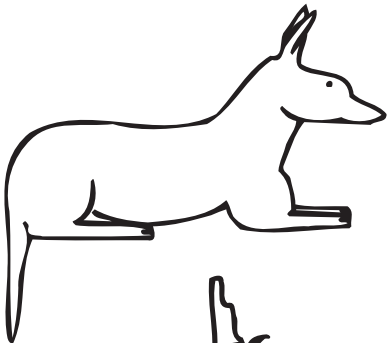
### **Taurus (The Apis Bull)**

This sacred animal had its own temple in Memphis where it was kept in surroundings of great luxury. The fame of the Apis Bull spread through the country and pilgrims would travel to see it. It was believed to be an oracle. The animal's behavior and movements were interpreted by the priests who presided over the temple. When the bull died, its soul passed onto another bull and the search for the new Apis Bull would begin. The common features that were sought were all black with a white square on the forehead and a white mark of an eagle on its back. A third important feature was a scarab-lumped shape under the tongue. Once the new Apis Bull had been identified, it was escorted down the Nile on an ornate boat that would befit the divine spirit contained by the Apis. Once at Memphis, the animal would live a life of great luxury eating the finest foods and would be attended to every minute of the day. No Apis Bull was allowed to live beyond twenty-five years. A constellation of the zodiac.



### **Ursa Major (Thigh of Set)**

It is not known why the Thigh and the Leg of Set are significant or why the limbs are separated across the sky. An interpretation might be that the two body parts and the gap between them reminds us of the fate of Osiris.



### **Ursa Minor (Jackal of Set)**

Polaris is associated with the death and coffin of Osiris. The whole constellation is seen as the Jackal of Set, a dark and loathsome creature, always plotting the ruin of the gods of light. It must be conquered by them again and again.



### **Virgo (Isis)**

Wife of Osiris and deity of fertility. A constellation of the zodiac.

## ***A Pronunciation Guide for the Egyptian Cylinder and Important Pharaohs***

**Akhenaton** \Ar-ken-ah-ton\

**Amenemhet** \Ar-men-em-het\

**Amenhotep** \Ar-men-ho-tep\

**Ament** \Ar-ment\

**Amommon** \Ar-mom-mon\

**Anubis** \An-eu-bis\

**Hatshepsut** \Hat-shep-soot\

**Horus** \Hoe-rus\

**Isis** \Eye-sis\

**Khafre** \Kaf-ree\

**Khem** \Kem\

**Khnum** \Ker-noom\

**Khufu** \Koo-foo\

**Menkawre** \Men-cow-re\

**Neith** \Ne-ith\

**Nephthys** \Nep-this\

**Osiris** \O-sigh-ris\

**Ptah** \Tar\

**Ptolemy** \Tol-e-me\

**Rameses** \Ram-e-seas\

**Sebek** or **Sobek** \Seb-ek or Sob-ek\

**Senusert** \Sen-oo-cert\

**Serk-t** or **Selket** \Cerk-et or Selk-et\

**Set** \Set\

**Snofru** \Snof-roo\

**Toth** \Thow-th\

**Tothmes** \Thooth-mes\

**Typhon** \Tie-fon\

**Zoser** \Zow-sir\

## MATERIALS

- STARLAB Portable Planetarium
- Ancient Egyptian Cylinder
- arrow pointer(s)
- audio tape of traditional Egyptian music
- pencils and paper
- clipboard

# Activity 1: Investigation and Identification of Particular Patterns in Relation to the Ancient Egyptian Cylinder

## Objectives and Aims

As an introduction to familiarize students to the constellations of the Ancient Egyptians.

## Suggested Levels for Presentation

All ages with suitable modifications.

## Integrated Subjects

- Science
- History
- Arts

## Process Skills

Cooperative learning • Observing • Pattern finding • Interpreting • Drawing

## Preparation

Read support material supplied with the Ancient Egyptian Cylinder and any other suitable resource information. Hand out the clipboards, pencils and drawing paper to the students. Decide in advance which particular part of the sky will be the starting point for the investigation prior to students entry into STARLAB. Note which patterns will appear. Ensure that the cylinder is correctly fitted to the projector and angled for 30° North. Play traditional Egyptian music if available as students enter STARLAB.

## Procedure

Once seated, gradually introduce the darkness by lowering the side lights. Explain to the students that throughout history, civilizations have seen the sky and interpreted what they saw very differently. Further explain that the differences stem from religious beliefs and scientific understanding. Explain that today's visit to the STARLAB is going to introduce them to a view of the sky as seen by the Ancient Egyptians around 2500 BC. Turn down the side lights and increase projection brightness. Without using the arrow pointer, ask the students, what patterns they can immediately put a name to, given their present knowledge. If necessary, use the arrow pointer to point out ankhs, pyramids and other Egyptian features and name specific constellations. Ask the students which particular features interest them. Increase the side lights gently so that background ambient light is just bright enough to allow students to see their worksheets. Ask students to draw the patterns of interest to them. If the teacher is fully prepared, rotate the cylinder and continue the exercise.

## Note

*As an alternative introduction to the ancient Egyptian sky, The 'Tragedy of Osiris' myth could be told and the constellations that are featured in the tale could be pointed out one by one as they are mentioned. To see the greatest number of constellations linked with the myth, set the cylinder for midnight in early December.*



### **Further Investigations**

In the classroom, compare drawings made by the students to the support information illustrations and comment on any feature that had captured the students' imagination in the STARLAB. Explain details regarding the named patterns or alternatively encourage the children to find out as much as possible about one or more patterns using various resources. The students pencilled drawings made in the STARLAB could now be colored in and completed with a title and brief explanation.

### **Special Note**

*To illustrate the huge passage of time, consider making a 'time string' of 5m length, suitably marked with flags to show important landmarks in history (make 1 meter of string length equal 1000 years).*

## MATERIALS

- STARLAB Portable Planetarium
- Ancient Egyptian Cylinder
- arrow pointer(s)
- audio tape of traditional Egyptian music
- pencils and paper
- clipboard

## Activity 2: Investigation of Constellations that Relate to Ancient Egyptian Religion

### Objectives and Aims

An introduction into the different deities of the Ancient Egyptians.

### Suggested Levels for Presentation

All ages but with modification.

### Integrated Subjects

- Arts
- Cultural Religious Beliefs
- History

### Process Skills

Observing • Listening • Inferring • Discovering • Pattern finding • Concluding • Interpreting

### Preparation

Read support material supplied with the Ancient Egyptian Cylinder and any other suitable resource information. Decide in advance which particular part of the sky will be the starting point for the investigation prior to students entry into STARLAB. Note which patterns will appear. Ensure that the cylinder is correctly fitted to the projector and angled for 30° North. Play traditional Egyptian music if available as students enter STARLAB.

### Procedure

- Once seated, gradually introduce the darkness by lowering the side lights. Explain to the students that throughout history, civilizations have seen the sky and interpreted what they saw very differently. Further explain that the differences stem from their religious beliefs and scientific understanding. Explain that today's visit to the STARLAB is going to introduce them to a view of the sky as seen by the ancient Egyptians around 2500 BC. Because of different ethnic and religious backgrounds of the students, it is important to explain that no one today believes in these gods or goddesses. Further explain that although the religions of the ancient Egyptians may seem strange to us, it has to be remembered that these faiths gave joy during the good times and also comfort during the bad times.
- Extinguish the side lights and increase projection brightness. Using the arrow pointer, pick out prominent constellations associated with the ancient Egyptian religions and name them. Ask the students why there are such close links with nature and animals. Ask why some gods have animal heads.
- Explain the meaning of some of the deities and focus attention upon the Scarab Beetle or Apis Bull and explain why these constellations are prominent or important.
- Ask the students which particular features interest them. Increase the side lights gently so that background ambient light is just bright enough to allow students to see. Ask students to draw the patterns of the deities of interest to them. If the teacher is fully prepared, rotate cylinder and continue the exercise.

### **Further Investigations**

In the classroom, compare drawings made to support information illustrations. Explain details within religious patterns. Encourage the students to use various resources to discover the nature and influences of these deities. The students pencil drawings made in the STARLAB could now be colored in and completed with a title and brief explanation. Ask students to investigate the different interpretations the Egyptians had regarding the motion and the changing nature of the sun. Students could be encouraged to investigate the Egyptian 'Creation' myth and compare it with the modern scientific view. Ask students to compare their own faiths with those of the Ancient Egyptians. What important differences and common themes can they see?

Further visits into the STARLAB can broaden knowledge by investigating constellations that represent Pharaonic gods like Khafre or 'Khufu.'

## MATERIALS

- STARLAB Portable Planetarium
- Ancient Egyptian Cylinder
- Celestial Coordinates Cylinder
- Northern Starfield Cylinder
- arrow pointer(s)
- audio tape of traditional Egyptian music
- pencils and paper
- clipboard
- Earth globe
- toy spinning top
- glow-in-the-dark letters indicating north, south, east and west

## Activity 3. Investigation into the Differences in Pole Stars Across the Ages

### Suggested Levels for Presentation

Ages 11 and above.

### Integrated Subjects

Geometry • Science • Math • History • Geography • Astronomy

### Process Skills

Observing • Listening • Inferring • Predicting • Discovering • Concluding • Marking • Plotting • Interpreting

### Terms and Concepts to Be Discussed

- The Precession of the Equinoxes
- Circumpolar Stars

### Preparation

Read support material supplied with the Ancient Egyptian Cylinder and any other suitable resource information. Become familiar with the stars Thuban in the tail of the 'Crocodile' and Polaris in 'Jackal of Set.' Attach glow-in-the-dark letters to indicate the four points of the compass around the STARLAB. Fit the Starfield Cylinder to the projector and adjust the projection of the night sky so that the North Pole Star aligns vertically with the glow-in-the-dark letter for north. Ensure that the projection cylinders to be used are correctly angled for 30° North.

### Procedure

Explain to the students that over immense periods of time the night sky has slowly changed, not necessarily because the stars have moved relative to each other but due to an effect called the 'precession of the equinoxes.' Ask the students if they are familiar with the North Pole Star, Polaris in the 'Little Dipper' (Ursa Minor). In the darkness of the STARLAB, demonstrate a rapid rotation of the Starfield Cylinder and comment that the North Pole Star (Polaris) appears almost stationary and can always be seen above the northern horizon for any person who lives north of the Earth's equator. Mention that certain stars appear not to set or rise and that these stars are called 'circumpolar stars.' Explain the importance of Polaris to past explorers. If available, replace the Starfield Cylinder with the Celestial Coordinates Cylinder and indicate the circular pathway above the northern horizon using the arrow pointer. Explain that this pathway corresponds to the movement of the North Celestial Pole and that, purely by luck, during our period of existence, Polaris appears to be close to the North celestial pole in the sky. If the Celestial Coordinates Cylinder is not available, continue the demonstration by showing the approximate pathway by using red pointer. To further illustrate precession, use an Earth globe or child's spinning top. Conclude the demonstration by replacing the Celestial Coordinates Cylinder with the Ancient Egyptian Cylinder. Point out the constellations of the 'Crocodile,' 'Jackal of Set' and the stars Thuban and Polaris respectively. Rotate the cylinder to show that Thuban and not Polaris is near stationary.

### **Further Investigations**

The following questions could be put to the students (or working in groups) back in the classroom.

*Has the North Pole moved here on the surface of the Earth?*

*When will the star Vega in the constellation of the 'Vulture' (today this constellation is called Lyra) be closest to the North Celestial Pole?*

*When will Thuban once more be the North Pole Star?*

*Why was Thuban and the other circumpolar stars important to the Ancient Egyptians?*

*Can the stars (consider The Pleiades) change position, relative to each other and if so, over what time span?*

## MATERIALS

- STARLAB Portable Plan-  
etarium
- Ancient Egyptian Cylinder
- arrow pointer(s)
- audio tape of traditional  
Egyptian music
- pencils and paper
- clipboard
- clinometer
- small camera tripod
- spirit level
- photo copy work sheets
- glow-in-the-dark letters  
indicating north, south east  
and west

## Activity 4. Investigation into Aspects of Pyramid Architecture and Specific Stars in the Sky

### Objectives and Aims

To investigate modern claims that 'passageways' leading from the burial tombs in the Great Pyramid are related to the stars.

### Suggested Levels for Presentation

Ages 11 and up with modification

### Integrated Subjects

Geometry • Science • Math • Literature • History • Arts • Geography • Map skills  
• Cultural Religious Beliefs • Archo-Astronomy

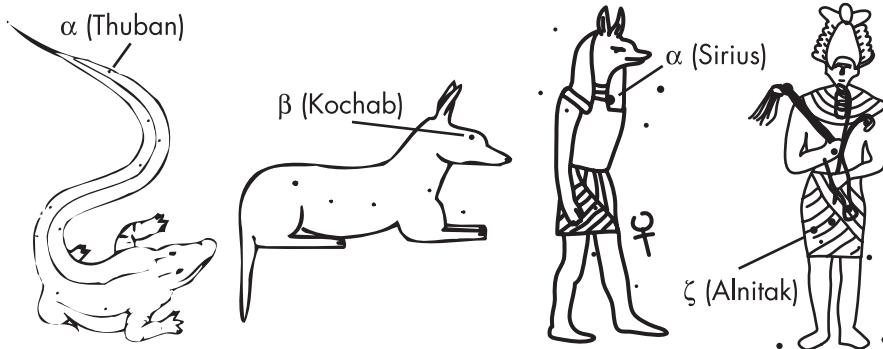
### Process Skills

Co-operative learning • Observing • Listening • Inferring • Predicting • Discovering  
• Pattern finding • Concluding • Marking • Plotting • Interpreting • Drawing

### Preparation

Read support material supplied with the Ancient Egyptian Cylinder and any other suitable resource information. The students should be familiar with the 'precession of the equinoxes' as detailed in Section 3. The teacher should become familiar with the stars Thuban (Alpha Draconis) in the tail of the 'Crocodile', Kochab (Beta Ursa Minor) in the 'Jackal of Set', Sirius (Canis Major) in Anubis and Alnitak (Zeta Orionis) in Osiris.

According to modern Egyptologists, the stars mentioned have the following associa-



tions with passageways in the Great Pyramid of King Khufu.

1. Thuban's upper culmination. Cosmic birth. Aligns with King's Chamber passageway facing north.
2. Kochab's upper culmination. Cosmic regeneration. Aligns with Queen's Chamber passageway facing north.
3. Alnitak's upper culmination. Osiris. High god of resurrection and rebirth. King's Chamber passageway facing south.
4. Sirius's upper culmination. Isis. Goddess of fertility. Mother of the Kings of Egypt. Queen's Chamber passageway facing south.

Attach glow in the dark letters to indicate the four points of the compass around the STARLAB. Adjust projection of the night sky so that the Ancient Egyptian North Pole Star (Thuban) aligns vertically with the glow in the dark letter for north. Using the spirit level, ensure that the STARLAB projector is perfectly levelled and that the Ancient Egyptian cylinder is very accurately angled for 30° North.

Use or construct a simple clinometer that consists of enlarged photocopy (30cm length would be ideal) of a protractor mounted on stiff card. Attach 20cm long plumb line and spherical weight at the intersection of radians and a simple sight tube (drinking straw) along base of semi-circle. Attach the clinometer to the pan head of a camera tripod. Play traditional Egyptian music if available as students enter STARLAB. Hand out clip boards, pencils and paper to students. In addition to star maps, hand out photocopied 'Table of Results' to record observations upon. The photocopies of the internal layout of the Great Pyramid are handed out at the end of the exercise.

### Procedure

- Tell the students, that over the past 120 years Egyptologists have suggested that there may be a link to the layout of the pyramids and the stars. In particular, the internal passageways in The Great Pyramid of Cheops (Khufu) has caused the most interest. Explain that this is a controversial issue as some Egyptologists have stated that these passageways are only ventilation shafts. Further explain that during the lesson the students will view the sky as it was 2500 BC. They will measure angular displacements above the horizon of four specific stars, namely, Thuban in the tail of the 'Crocodile,' Kochab in the 'Jackal of Set,' Sirius in Anubis and Alnitak a belt star in Osiris. Extinguish side lights and increase brightness of star projector. Proceed with the identification of the target stars. Once all are identified explain that stars achieve maximum and minimum height positions in the sky depending upon their motions as they cross the southern or northern horizon.
- Demonstrate by gently rotating cylinder so that Sirius gains its highest position in the sky when above the southern horizon. When this position is reached, Sirius has 'upper culminated.' Demonstrate 'lower culmination' by pointing out Kochab and gently rotating the cylinder to show the star in its lowest position above the northern horizon. When this position has been reached, Kochab has 'lower culminated.'
- With the students working individually or in teams, they measure angular displacements above the horizon for the four stars, noting upper and lower culminations. To reduce errors, the students must work as close as possible from the center of the STARLAB and at the same height of the projection cylinder light bulb. Observations are recorded for eventual analysis. In the classroom, the results of the observations are compared with the sectional drawings of The Great Pyramid. The students are asked to consider if they are convinced by the associations or do they believe that the correlation is pure happenstance.

### Further Investigations

Students could further broaden the investigation relating other star angles and Egyptian architecture given access to relevant resources information. The teacher should, however, warn students that forming patterns where patterns do not exist, is extremely easy for the human imagination to do. However, as this is an area of unexplored research the teacher and students should make the appropriate authorities aware if a chance discovery is made!

### Special Note

*To reduce errors, averages should be used. An accuracy of approximately 1.5° and possibly better can be expected.*

## Great Pyramid Chambers and Shafts

### Great Pyramid Statistics

- Height.....481 ft
- Base length...755' 9" (average)
- Incline .....51° 50'
- Total weight6,500,000 long tons\*
- Weight of stones..... 2.5 – 15 long tons\*
- Number of Stones..... 2,300,000
- Floor area .....571,158 square ft
- Date of construction .....2528 BC
- Commissioner .....King Khufu

Lintel stones above King's chamber weigh an estimated 50 long tons.\*

\* (1 long ton = 2240 pounds)

### Angle of Chambers and Stars at Points of Culmination

- Southern King's chamber. Alnitak in Osiris (Orion) .....45° 14'
- Southern Queen's chamber. Sirius in Anubis (Canis Major).....39° 30'
- Northern King's chamber. Thuban in the Crocodile (Draco) .....32° 28'
- Northern Queen's chamber. Kochab in Jackal of Set (Ursa Minor).....39°

### Special Notes

*The northern and southern Queen's Chamber passageways do not exit out of the pyramid. Culmination's for the target stars do not occur simultaneously. At the time of writing, no astronomical association is proven to exist for the subterranean chamber facing north (it has an angle of 26° approximately).*

