

Lecture 17

Greek Science, Technology, and Agriculture

The Aegean World and The Rise Of Hellenism

There is evidence of civilization appearing in the Bronze age (3200 to 2000 BCE) in mainland Greece and neighboring islands. The period between 2000 and 1600 BCE, known as the Middle Bronze Age, marks the arrival of the first Greek speaking Indo-European populations. By this time a complex urban civilization developed in Crete. By 1600 BCE there is evidence of royal tombs at Mycenae, located in the northeast Peloponnese (the peninsula jutting out from the mainland). The Mycenaean kingdoms developed an agriculture including irrigation and the draining of Lake Coapis. Between 1400 and 1300 BCE Mycenaean trade developed in the central and eastern Mediterranean. Between 1200 and 800 BCE, a period known as Greek Middle Ages, Mycenaean culture gave way to the Greek City-States. This is the period known to us from the stories of the *Iliad* and the *Odyssey*, epic poems attributed to Homer, that tell the story of the Trojan Wars and Ulysses' return to Ithaca. These stories are part of the oral tradition that probably date from the Mycenaean period.

The time frame between 750 to 450 BCE is known as the era of **Hellenism**. This was the great period of Greek colonization probably instigated by the shortage of arable land on the Greek mainland. Colonialization extended in the Mediterranean region as far west as Spain (Iberia) and as far east as Northern Boundary of the Black Sea (Fig. 17-1). As a result, some of the most famous Greek Temples that have survived are found outside of the Greek mainland e.g. in Sicily (Agrigento), Italy (Paestum) and Turkey (Ephesus and Pergamont). This period coincides with innovations in all fields of thought and technology. The culture reached its high point in the fifth century BCE, a classical period known as the Golden Age of Greece, familiar to us through its architecture and magnificent art, chiefly statuary (Fig. 17-2) and mosaics, poetry, and the musings and thoughts of the great Greek philosophers. It was also an era of battles, plagues, famines, intolerance, civil war, and confrontation.

Hellenism, is associated with the flourishing of the arts and sciences. Greek culture, based on the domination of ideas rather than technology *per se*, spread throughout the entire Mediterranean basin and had a powerful influence on Roman culture. Today Greek and Latin (the language of ancient Rome) are the basis of scientific English. The culture of the West is based on a fusion of Greek culture, Babylonian and

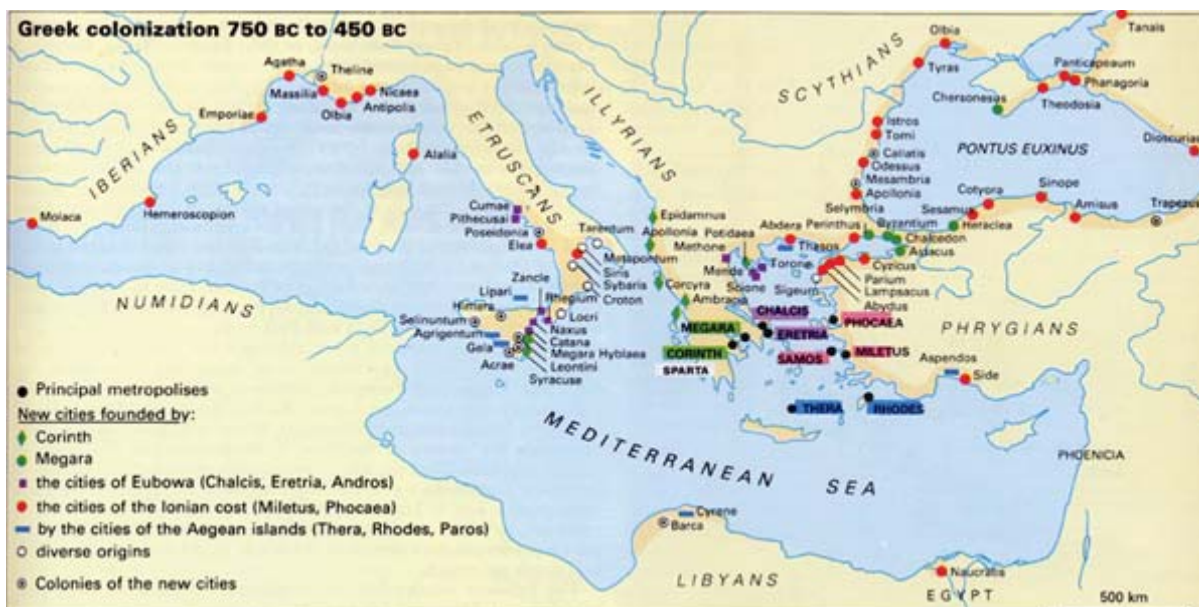


Fig. 17-1. Greek colonial expansion. Source: The Harpers Atlas of World History.

Egyptian Science, and Semitic religion. The art is typified by idyllic realism, included depictions of gods, animals, particularly horses, and plants, and includes agricultural practices (Fig. 17-3, 17-4).

One of the cultural developments of Greek thought was the **museum**, originally the Temple of the Muses [daughters of Zeus & Menemosyne (memory)]. The muses became the patron goddesses of the humanities:

- Cleio — history
- Euterpe — lyric poetry
- Thaleia — comedy
- Melpomene — tragedy
- Terpsichore — dance and music
- Erato — erotic poetry
- Polymnia — hymns
- Urania — astronomy
- Calliope — poetry



Fig. 17-2. Horse head from the Parthenon.

The museum became part of the palace, “the palace of culture,” and later a kind of medieval college and research institute. The development of the concept of organized centers of learning (the University) descend from this period.

The **Academy** was the school of the philosopher Plato (427–327 BCE) located in a grove of trees. The “Groves of Academe” are a synonym for present day colleges and universities; college professors are known as Academics who still refer to the University as “The Academy” and its curricula as “Academic Studies.” Aristotle (384–322 BCE) student of Plato called his school the **Lyceum**, still the French word for school.

Beginnings of Science

The beginnings of science date to the 6th century BCE in Greece, Palestine, Babylonia, India and China. A number of philosophers stand out from the crowd. Note that the word for science, derived from the Latin word *scientia*, to know, came much later.

Democritus of Abdera (ca. 470?–362? BCE) Founder of the Atomic Theory. Also had theories on the nature of plants; thought plant diversity was due to differences in the atoms of which they were composed.

Hippocrates (460?–359? BCE). Disciple of Democritus, was a Greek physician who is now considered the “Father of Medicine.” Born on the Island of Cos, he was associated with the cult of Asclepius, the Greek god of healing whose staff entwined with a serpent became the symbol of medicine. In the 7th century BCE, Asclepius aided by his two daughters, Hygeia and Panacea, superseded Apollo of the greatest of the healing gods, and temples in his name were built to heal the sick. Legend has it that the centaur Chiron taught Asklepius pharmaceutical knowledge about drug plants.



Fig. 17-3. Harvesting olives



Fig. 17-4. Greek plow

Hippocrates, considered the originator of a Greek school of healing, was the first to clearly expound the concept that diseases had natural causes. Various works attributed to him and his school is contained in the *Hippocratic Collection*, which includes *The Hippocratic Oath*, Aphorisms, and various medical works. He was an expert in diagnosis, predicting the course of disease. Based on the color and pallor of the ill, disease was considered to be an imbalance of the four “humours”: blood, phlegm, yellow bile, and black bile, a concept that was to affect medicine for 2000 years. This concept persists in the following terms that describe distinctive temperaments: sanguine (warm and ardent), phlegmatic (sluggish, apathetic), and bilious (ill humored). Healing emphasis was placed on purges, attempts to purify the body from the illness produced by excesses or imbalance of humors. Hippocrates particularly noted the influence of food and diet on health, recommending moderation. In the work *On Ancient Medicine*, differences in individual response to food are noted such that some can eat cheese to satiety while others do not bear it well, a diagnosis of lactose intolerance. The use of drugs was not ignored and between 200 and 400 herbs were mentioned by the school of Hippocrates. (Note: **Rhizotomoi** = Greek rootdiggers; **pharmacopuloi** = drug merchants; thus our word *pharmacy* is derived from the Greek word for remedy or drug.)

Aristotle (384–323 BCE) of Macedonia. Writings are climax of the Golden Age of Greece. Student of Plato (427?–327 BCE) and teacher of Alexander the Great (356–323 BCE) Plato, a philosopher, was interested in the search for the ideal while Aristotle was involved in a search for facts and explanations. Important writings in physics (unfortunately, many incorrect ideas persisted for almost 2000 years; e.g. that the speed of objects being dropped is proportional to mass). The descriptive writings in biology were excellent. Examples include *On Psyche*, *Histories of Animals*, *Generation of Animals*, *Parts of Animals*. Writing on plants are lost, but Aristotle cites five of his own works. It was Aristotle who developed the concept of life force or **vitalism**, the idea that life is due to a force beside the ordinary workings of chemistry and physics. Modern biology has been chipping away on this concept, but the last vestiges of vitalism will probably be only discarded when life is actually created. Science is getting close. The religious concept that humans are essentially different from other animals is an extension of vitalism, (anathema to religious believers who insist on a divine spark, or soul).

Theophrastus of Eresus, city of Lesbos (371–287? BCE). The founder of the botanical sciences and thus known as the Father of Botany; legatee of the Aristotle’s Lyceum and was bequeathed the library. Writer of 227 treatises, (on religion, politics, ethics, education, rhetoric, mathematics, astronomy, logic, meteorology, natural history; had over 2000 disciples or students, averaging 60 per year). Two botanical works survived: *History of Plants* and *Causes of Plants* (may be lecture notes). These are the earliest books of this kind in world literature but surely not the first. Deals with 500–550 species. Other works that survive include *On Stones* and *Character Sketches* (still good reading). See Lecture 19.

History of Plants (Historia de plantis) Largely descriptive, Distinguishes parts of plants. Nine books:

1. parts of plants and their nature; classification;
2. propagation (especially trees);
3. wild trees;
4. geographic botany, trees related to districts;
5. timber of various trees;
6. Undershrubs;
7. herbaceous plants;
8. cereals, pulses, summer crops;
9. juices of plants.

Causes of Plants (De causis plantarum) More philosophic but still full of facts. Six books:

1. Generation and propagation of plants;
2. Things which help the increase of plants;

3. Plantation of shrubs and preparation of the soil, viticulture;
4. Goodness of seeds and their degeneration;
5. Diseases;
6. Savors and odors.

Although there is much practical information Theophrastus is interested in plants for their own sake. “Given differences between plants or organs, how do we account for them?” “What are the intentions of nature?” His classification of plants endured for 2000 years. He studies form and function, germination, distinguished monophyllous (monocots) and polyphyllous (dicocotyledonous) plants; leaf descriptions (still used); codified names of 500 plants; considered ecological groupings, propagation. Describes such facts as mistletoe germinating in oaks. Can still be read with interest by horticulturists. (For example mentions that shoots close to the stem root better, a correct observation still incompletely understood.)

Alexander the Great (356–323). Alexander, king of Macedon, son of Philip of Macedon, student of Aristotle, extended Greek influence from the Greek isles to India. At his death in 323 BCE his kingdom was divided among his generals. The Ptolemies were Greco-Egyptian rulers of Egypt from 323 to 30 BCE. Center of learning shifted to Alexandria in Egypt, one of the many cities named after Alexander. There occurred a fusion of Egyptian, Mid-eastern, and Greek culture. The Greek school in Alexandria with its famous library (Fig. 17-5) was destroyed in 415, perhaps by fanatical Christians, a tremendous loss for all humankind.

References

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Fig. 17-5. Reconstruction of the library of Alexandria. Source: Fortin 1999, Syria.