Agroforestry at the Ancient Maya City of Calakmul, Mexico

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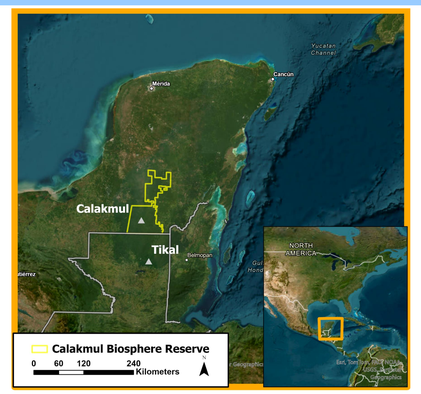
Abstract

The ancient city of Calakmul, once a leading polity of the Classic Maya world, has drawn the attention of scholarly investigation for nearly a century. Despite the long history of academic research, the intricate relationship of the densely populated center with its surrounding tropical forest environment has only recently come into clear focus. How did they provide adequate supplies of food and forest products to expanding populations during an occupation that lasted well over a millennium? These and other questions have been the focus of a recent study conducted by a multidisciplinary team of biologists, geographers and archaeologists. In this poster we will address these questions using the identification of wood remains using a combination of light and Scanning Electron Microscopy.

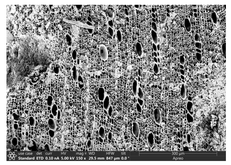
Project Location



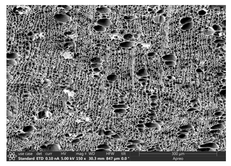
Introduction

Calakmul is located in the central lowlands of Mesoamerica, 35km north of the Guatemalan border. Identified with a "snake head glyph“ representing the Kanul dynasty, it is one of the largest of all Maya lowland sites that hold significant value to the development of the Maya society. Due to its central positioning in the Maya lowlands, it also contributed economically by controlling important in-land trade routes throughout the Early Classic. In addition, because of its location on the bajo (wetlands) edge, it provided fertile soils and abundant natural resource outcrops for the region. Furthermore, the site includes rich monumental architecture such as pyramids, buildings, and various stele that provide historical depictions. It also contained a network of canals and reservoirs that supported a population of around 50,000 individuals or more. Their power eventually led to rivalries with other superpowers such as Tikal. Calakmul held significance as a Preclassic center that survived the "upheavals“ of the Terminal Preclassic then expanded and developed into a major power in the Classic period.

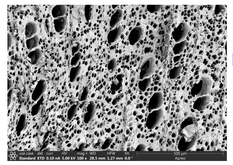
Results & Discussion



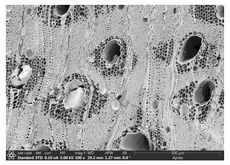
Rutaceae
***Zanthoxylum sp.*:**
Species in this genus have been used medicinally to treat a wide variety of ailments including headaches, diarrhea, dysentery, convulsions, and chicken pox like rashes.



Malpighiaceae
Malpighia glabra:
The species boasts edible fruits. A treatment for diarrhea is derived from the plant. It is also used in the tanning of leather.

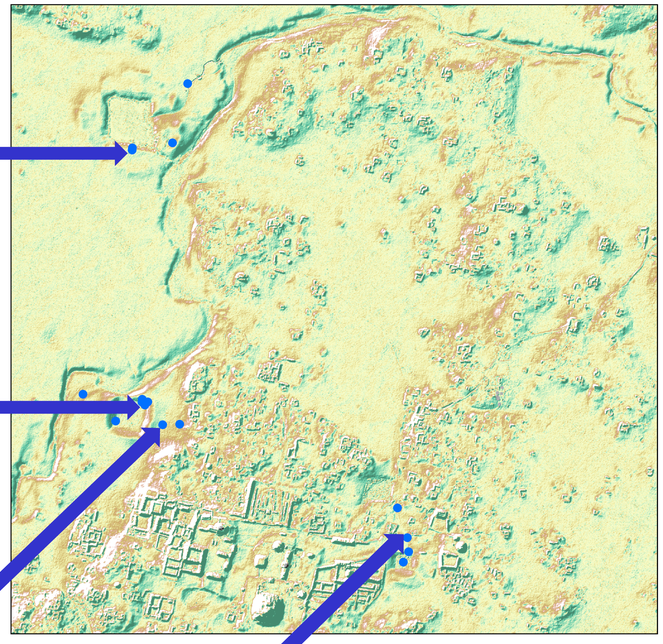


Sapotaceae
Pouteria sapota:
This species has year-round production of large edible fruits. Its seeds are used for flavoring. Oil from the seed is also used in hair care.

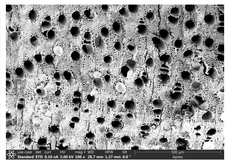


Fabaceae
Hymenaea courbaril:
Its wood is used in boat and furniture manufacturing. The sweet floury aril surrounding the seeds is eaten. Its resin is used in incense.

Anacardiaceae
Astronium graveolens:
Its hard, heavy wood which is used in construction earned the species the nickname of ‘the axe-breaker’.



Excavation Locations 2022



Rhamnaceae
Krugiodendron ferreum:
This species has extremely hard wood that is suitable for construction. Additionally, the roots and bark are used in medicines.

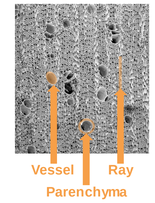
Table 1. Utility of Hardwood Tree Species Represented in Charcoal

Family	Taxon	Utility
Boraginaceae	*Bourreria sp.*	Edible fruits
Celastraceae	*Maytenus sp.*	Used medicinally
Chrysobalanaceae	*Hirtella sp.*	Bark is used in tanning leather; Firewood
Combretaceae	*Terminalia sp.*	Wood used in general construction; Bark & fruit used for black dye
Euphorbiaceae	*Gymnanthes lucida*	Hard, heavy wood presumably used for construction
Fabaceae	*Lysiloma latisiliquu*	Lysiloma species are used to tan leather
	Myroxylon balsamum	An ingredient of incense & perfumes; Used medicinally
Meliaceae	*Trichilia hirta*	Oil from the seeds used for hair care
Muntingiaceae	*Muntingia calabura*	Fiber; Medicine; Food
Myrtaceae	*Psidium guajava*	Edible fruit; Wood used in construction; Used medicinally as antibiotic & to control inflammation
Polygonaceae	*Coccoloba diversifolia*	Edible fruits; strong heartwood suitable for construction
Rubiaceae	*Calycophyllum candidissimum*	Used in the construction of hand tools including bows
	Exostema caribaeum	Wood used in furnishing & as posts; Medicinally used as a substitute for quinine
	Guettarda combsii	Wood is used in construction; Medicine
Rutaceae	*Zanthoxylum fagara*	Used medicinally to treat fever, chicken pox like rash, and convulsions
Salicaceae	*Homalium sp.*	Wood is used in construction; Medicine
Sapindaceae	*Allophylus sp.*	Edible fruit
	Dodonaea viscosa	Spice; Oil; Medicine; Fuel
	Exothea diphylla	Wood used for construction; Fuel

Guettarda combsii emerges from the canopy

Methods

Transverse Face of *Muntingia calabura*



Collection

1) Carbonized wood fragments large enough to be seen with the unaided eye were extracted from the soil at the archaeological site during excavation.

Identification

1) Carbonized wood remains are sent to the laboratory and are separated from mineralized clay with the aid of a stereo microscope. Tangential and transverse faces of charcoal are mounted on aluminum stubs then coated with gold in preparation for SEM imaging.
2) A FEI Apreo Scanning Electron Microscope housed in the Advanced Materials Characterization Center allowed for further identification of archeological hardwoods.
3) A technical description of the samples including size and arrangement of vessels or tracheids, rays, and parenchyma was prepared for each specimen.
4) For identification, the Inside Wood database was used to compare features of the unknown samples to known hardwood species from Central America.

Conclusions

The ancient Maya highly modified the environment surrounding the ceremonial center of Calakmul. Modifications not only included grand pyramids, large marketplaces, palaces, and residences but large-scale hydrological features including reservoirs. Excavations at three of these massive reservoirs resulted in the collection of carbonized plant remains which were processed in this research. The charcoal highlighted in this research was found in association with pot shards, shell, obsidian and other lithic artifacts indicating the charcoal represented plants that were burned at the time of occupation by the ancient Maya.

The ancient Maya carefully managed their forest to obtain fuel, timber, fiber, food, medicine, and ceremonial materials. Twenty-four species representing eighteen plant families were identified from the charcoal. These species represented a wide range of uses for the ancient Maya.

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