WOOD REMAINS FROM TEL NAMI, A MIDDLE BRONZE IIA AND LATE BRONZE IIB PORT, LOCAL EXPLOITATION OF TREES AND LEVANTINE CEDAR TRADE[1]

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Lev-Yadun, Simcha *(The Zinman Institute of Archaeology, University of Haifa, Haifa 31905, Israel),* **Michal Artzy** *(Center for Maritime Studies and Zinman Institute of Archaeology, University of Haifa, Haifa 31905, Israel),* **Ezra Marcus** *(Center for Maritime Studies and Zinman Institute of Archaeology, University of Haifa, Haifa 31905, Israel; and Wolfson College, Oxford, OX2 6UD, U.K.), and* **Ragna Stidsing** *(Center for Maritime Studies and Zinman Institute of Archaeology, University of Haifa, Haifa 31905, Israel).* WOOD REMAINS FROM TEL NAMI, A MIDDLE BRONZE IIA AND LATE BRONZE IIB PORT, LOCAL EXPLOITATION OF TREES AND LEVANTINE CEDAR TRADE. *Economic Botany 50(3):310–317, 1996.* *Thirteen Middle Bronze Age IIa and four Late Bronze Age IIb (ca. 1950–1750 B.C. and thirteenth century, B.C., respectively) pieces of charcoal or water logged wood were found in the recent excavations of Tel Nami, a small port on the coast near Mount Carmel, Israel. These included* Cedrus libani *(cedar of Lebanon) (three samples), and local tree species that still grow today in the vicinity of the site*—Pinus halepensis *(Aleppo pine) (one sample),* Olea europaea *(olive tree) (five samples),* Quercus calliprinos *(kermes oak) (three samples),* Quercus ithaburensis *(Mt. Tabor oak) (four samples), and* Quercus sp. *(one sample). The discovery of* Cedrus libani *in a Middle Bronze Age IIa port is one of the earliest published examples of cedar wood from Israel. Together with other artifactual evidence for maritime trade from Tel Nami, this find suggests that a maritime trade in cedar wood existed along the Levantine coast.*

Holz-Überleibsel Von Tel Nami, Ein Mittel-Bronze IIa und Spät-Bronze IIb Hafen: Lokale Ausnutzung Von Bäumen und Levantinischem Zedern-Handel. *17 Stücke Holzkohle oder voll Wasser gesogenes Holz, 13 aus Mittelbronze IIa und 4 aus Spätbronze IIb (1950-1750 v. Chr., und 13. Jhdt. v. Chr.) wurden in der kürzlichen Ausgrabung von Tel Nami gefunden, einem kleinen Hafen nahe dem Karmelberg, Israel. Diese Stücke enthalten* Cedrus libani *(die Libanon-Zeder), 3 Exemplare, und lokale Baumarten, die bis heute in der Gegend waschsen*—Pinus halepensis *(Aleppo-Fichte), ein Exemplar,* Olea europaea *(Ölbaum), 5 Exemplare,* Quercus calliprinos *(Kermes-Eiche), 3 Exemplare,* Quercus ithaburensis *(Tabor-Eiche), 4 Exemplare, und Eichenarten, 1 Exemplar. Die Entdeckung von* Cedrus libani *in einem Mittelbronze IIa-Hafen ist eins der frühesten publizierten Vorkommen von Zederholz aus Israel. Zusammen mit anderen Zeugnissen von Seehandel aus Tel Nami legt dieser Fund die Annahme nahe, daß Seehandel in Zederholz längs der levantinischen Küste zu diesem frühen Zeitpunkt existiert hat.*

Key Words: charcoals; cedar trade; *Cedrus libani*; exploitation of trees; Late Bronze; Middle Bronze; wood remains.

The Tel Nami region is situated along the southern Carmel coast about 15 km south of the modern city of Haifa (Fig. 1). The peninsula of Nami, first identified by the Survey of Western Palestine as Jezirat en-Nami, juts some 150 m into the Mediterranean sea and is connected to the shore by a low sandy spit that is subject to occasional marine inundation. The site's geographical position, on a relic of an aeolianite sandstone (kurkar) ridge near the mouth of the Me'arot river, favored the establishment of a settlement based around a natural anchorage (Fig. 2; Artzy 1990, 1991, 1994, 1995).

Excavations at Tel Nami and Nami East indicate that these sites were first settled in the Middle Bronze Age IIa (ca. 1950–1750 B.C.). Thus far, the greatest horizontal exposure of remains of this period is in Area D, on the southeastern edge of Tel Nami. At least two distinct architectural phases have been discerned, both

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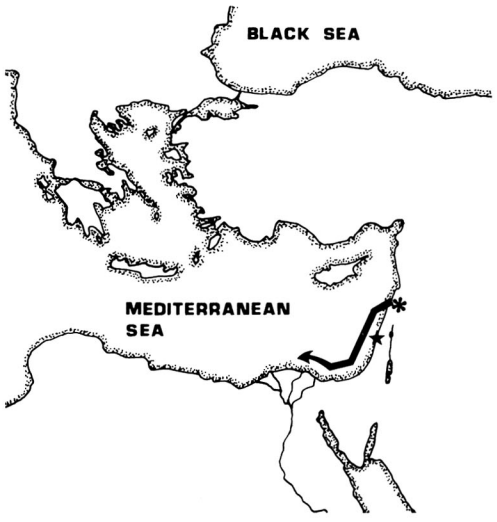


Fig. 1. The geographical setting of Tel Nami (star) in the Eastern Mediterranean region. The asterisk indicates the forests of *Cedrus libani* in Lebanon, and the thick arrow the coastal route of cedar trade from Lebanon to Egypt.

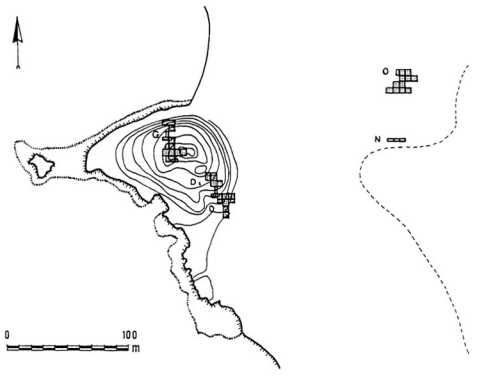


Fig. 2. The map of Tel Nami and the excavated areas.

of a similar orientation and layout, suggesting a planned settlement of rectangular rooms, courtyards, alleyways and a drainage system. Rooms of the final phase appear to have been destroyed in a fierce fire. One room contained an assemblage (Locus 356) comprising over 30 complete pottery vessels, charred wood and seeds such as grapes, chickpeas, lentils and an imported Aegean legume *Lathyrus clymenum* L. (Spanish vetchling) (Artzy and Marcus 1991; Kislev, Artzy, and Marcus 1993).

The Late Bronze Age II (ca. thirteenth century B.C.) resettlement of Tel Nami has been most extensively documented in Area G, although substantial evidence for this period exists in Areas D and D_1, too.

Provenience of the Wood Samples

Thirteen wood samples of the Middle Bronze Age IIa were collected from two types of contexts: 10 charred pieces from settlement levels in Area D, and three waterlogged pieces from a well in Area 0 (Table 1). The specimens from Locus 356, belonging to the last phase of habitation during this period at Tel Nami, presumably have their origin in the superstructure of that room, which collapsed during the conflagration. Those from loci 503 and 510 are from recently excavated levels whose precise stratigraphical position in the local Middle Bronze Age IIa sequence has not yet been established. The samples from Locus 160 belong to the clay layer at the bottom of the well. This fine dark clay layer represents the period in which the installation was in use. Considering that the well became inoperative and was filled with Middle Bronze Age IIa refuse, it and the wood presumably predate the final phase in Area D (Marcus 1991).

The four Late Bronze Age pieces of wood originate in Area G and D_1, all certainly from the Late Bronze Age II period, most likely the final LB IIb phase of habitation. One example

Table 1. The wood remains from Tel Nami.

Middle Bronze Age II (MBIIa) ca. 1950–1750 B.C.				
Taxon	Number of samples	Area	Locus	Context
Cedrus libani	3	O	160	well
Pinus halepensis	1	D	356	storage room
Olea europaea	2	D	356	storage room
	1	D	503	building
Quercus calliprinos	2	D	356	storage room
Q. ithaburensis	3	D	356	storage room
Quercus sp.	1	D	510	building
Late Bronze Age (L8 IIb) ca. thirteenth century B.C.				
Taxon	Number of samples	Area	Locus	Context
Olea europaea	2	G	248	building
Quercus calliprinos	1	G	43	chisel handle
Q. ithaburensis	1	D_1	233	building

is from the handle of a bronze chisel. Apart from the handle, the other examples could derive from the superstructure of the destroyed settlement or from wood fuel.

The wood remains recovered were identified. They include both local forest and cultivated trees, along with imported wood from the cedars of Lebanon in the MBIIa—one of the earliest published records of cedar wood imported to Israel.

Materials and Methods

Samples 5–10 mm long were taken for identification from the charcoals and waterlogged wood. Cross, tangential and radial longitudinal sections from the soft, waterlogged wood were prepared using a sharp razor blade. Sections or blocks of cross, tangential and radial longitudinal planes were prepared from the pieces of charcoal using a small metal saw and a sharp razor blade, mounted on metal discs and coated with gold for scanning electron microscopy. Samples of the three water-logged specimens were dehydrated in a series of ethanol—25%, 50%, 75%, 96%, 100%, 1:1 100% ethanol/Peldri II (Pelco), 100% Peldri II, all steps 12 hours while shaking. Then the bottles were opened to let the Peldri II evaporate. Cross, tangential and radial longitudinal planes were prepared, mounted on metal discs and coated with gold. All samples were studied under a Philips 515 SEM at 20 kV, at various magnifications. The anatomical characteristics were recorded, and compared with wood samples from recent trees and shrubs studied under both light and scanning electron microscopes, and with published monographs on xylem anatomy (Fahn, Werker, and Baas 1986; Greguss 1955; Schweingruber 1990). In addition, a botanical survey was also conducted to determine what tree species grow today in the vicinity of the site.

Results

The anatomical examination revealed that the wood remains from Tel Nami from the Middle Bronze Age IIA came from five tree species: *Cedrus libani* Loud., *Pinus halepensis* Mill., *Olea europaea* L., *Quercus calliprinos* Webb and *Quercus ithaburensis* Decne. (Table 1; Fig. 3–10). One of the charcoals (L. 510) was in an extremely bad condition, and almost disintegrated during handling, and under the electron beam of the SEM. Because of the state of preservation of this specimen, only the genus (*Quercus* sp.) (oak) could be determined. However, the remains were full of fungal hyphae, indicating advanced decay of the beam before it was burned. The three specimens of *Cedrus libani* all originated from a well in area O that was used as a refuse dump. All other species were found in area D.

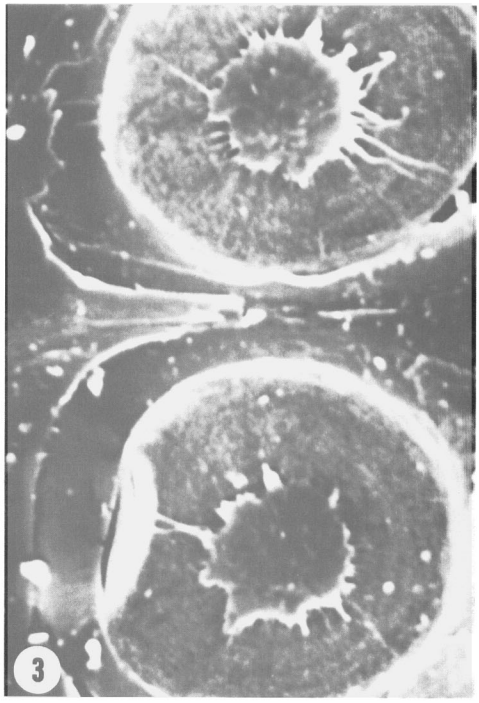
The specimens from the Late Bronze Age layers include two *Olea europaea* charcoals, a charred chisel handle made of *Quercus calliprinos* (G 24-1) and a charcoal of *Quercus ithaburensis* from Area D_1 (Table 1).

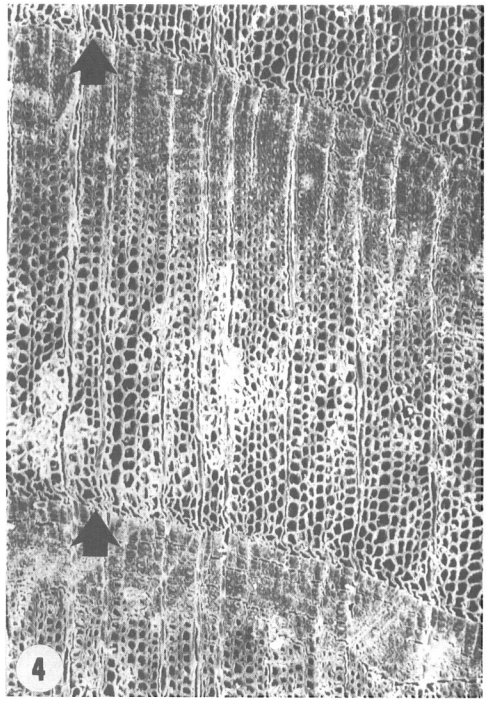
The anatomical criteria used for the identification of the plant material are given in the appendix.

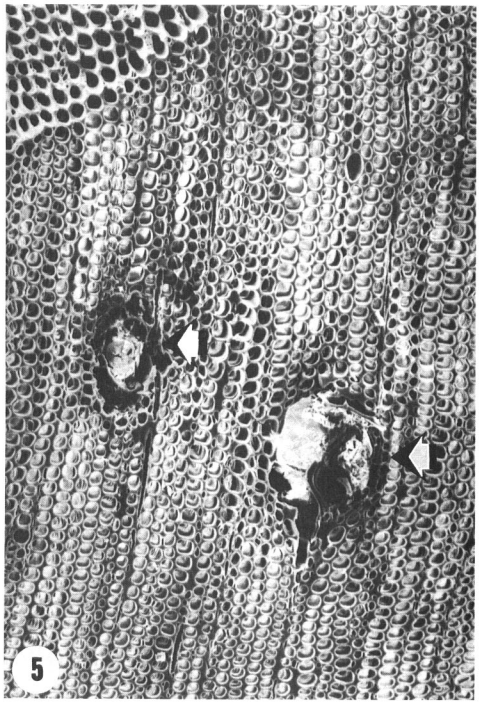
Discussion

Of the remains of five woody species that have been identified, four are local trees (*Pinus halepensis, Olea europaea, Quercus calliprinos,* and *Quercus ithaburensis*), while the last, *Cedrus libani,* clearly indicates imported timber. Today, natural stands of *Pinus halepensis, Olea europaea, Quercus calliprinos,* and *Quercus ithaburensis* exist on Mount Carmel, several kilometers from Tel Nami. Moreover, we found natural regeneration of *P. halepensis* and *Olea europaea* occurs on the sandstone ridge about 1 km from Tel Nami. Therefore, from both ecological and archaeological points of view these species should be considered natural within the local catchment of the inhabitants. Although the remnants of woody species probably indicate that they all grew within the catchment area of the site, their relative abundance in the site may simply reflect human preference.

Although *Olea europaea* is a wild plant in the vicinity of the site today, it was already a very important cultivated tree in the Middle and Late Bronze Ages (Zohary and Hopf 1993), and olive oil was a major agricultural product exported from Canaan (Stager 1985). Olive wood composes about 45% of the charcoals excavated in Israel in Bronze Age layers (Liphschitz et al. 1991). Thus, in addition to their use as a crop, olive trees were an important source of timber or firewood. It is a common practice to prune most of the branches in old olive trees to renew their productivity. This is a major source of olive wood. Olive wood is praised as firewood, for charcoal production and for manufacture of delicate wooden objects (Zinger 1985). The impor-







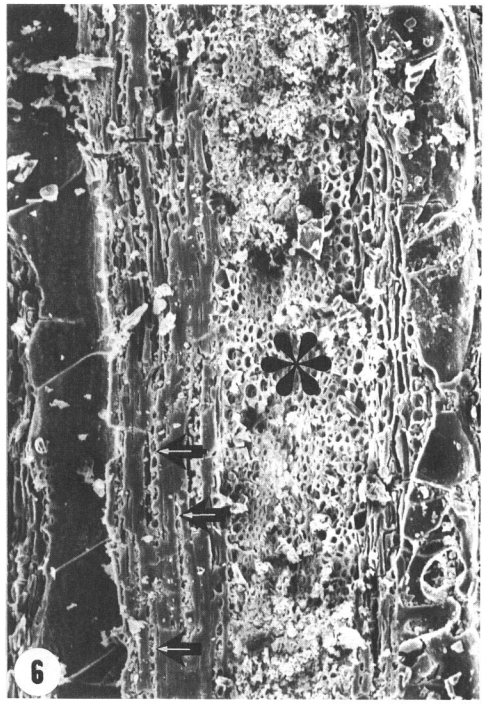


Fig. 3. A part of a tracheid of *Cedrus libani* showing two fringed bordered pits typical to this species (×3840).
Fig. 4. A cross section in the xylem of *Cedrus libani* showing two growth ring borders (arrows) (×82).
Fig. 5. A cross section in the xylem of *Pinus halepensis* showing two resin ducts (arrows) (×144).
Fig. 6. A tangential longitudinal section in the xylem of *Quercus ithaburensis* showing a huge aggregate ray (asterisks), small uniseriate rays (arrows) and vessel at left (×176).

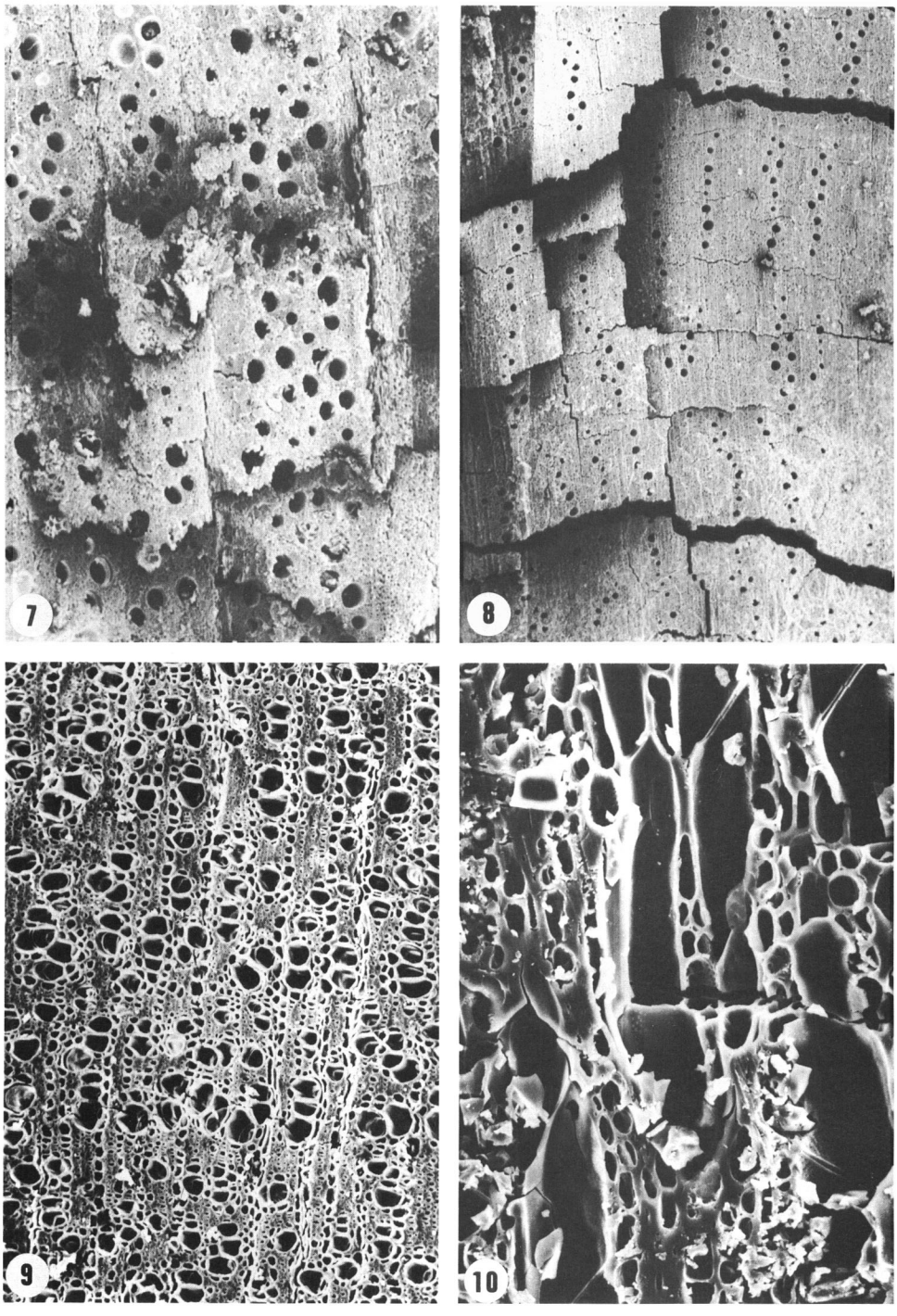


Fig. 7. A cross section in the xylem of *Quercus ithaburensis* showing a wide band of vessels (×288).
Fig. 8. A cross section in the xylem of *Quercus calliprinos* showing narrow bands of vessels (×24).
Fig. 9. A cross section in the xylem of *Olea europaea* showing arrangement of vessels (×160).
Fig. 10. A tangential longitudinal section in the xylem of *Olea europaea* showing the width and height of the rays (×480).

tance of the olive is also evident from the pattern of *Olea* pollen frequency in Lake Kinneret (Sea of Galilee) sediments near Beit Yerah (Khirbet Kerak). There, a rise in its pollen frequency starts in the 3rd millennium B.C. following the spread of its orchards near the Early Bronze Age settlement (Baruch 1986).

Pinus halepensis is found infrequently in Bronze Age layers in Israel. It was found in Late Bronze Age Timna (Fahn and Zamski 1988; Werker 1988), Middle Bronze Age II Tel Aphek and Late Bronze Tel Gerisa (Liphschitz 1987). Although this species spreads following fires and other man-made disturbances, because of its serotinous cones and winged seeds (Acherar, LePart, and DeBussche 1984; Shaw 1914), it is not clear from our find whether such conditions occurred in the vicinity of Tel Nami in the Middle Bronze Age IIa. Our find indicates that this species grew in the vicinity of Tel Nami, but without palynological data, it is impossible to determine how common it was in the landscape. There is a possibility that *P. halepensis* was imported to Tel Nami along with *Cedrus libani.* However, we prefer to use Ockham's razor approach—when a plant species is known to grow in the vicinity of a certain site, the inhabitants will use the local plant rather than import it.

Cedrus libani was an important commodity in the Levantine maritime trade for thousands of years, in particular as an import from Lebanon to Egypt (Meiggs 1982; Mikesell 1969). Since the three specimens of *Cedrus libani* originated from a garbage dump, we have no indication of the type of use of cedar wood at Tel Nami. However, these dumped pieces of wood should reflect the local use of cedar wood or a single imported artifact that was broken. We propose that this reflects either direct import or an offshoot from the main transport of cedar wood to Egypt.

The ecological setting in which *C. libani* grows is not found in Israel today. Mount Carmel is the only place in the vicinity of Tel Nami where *C. libani* could have grown if a considerable climatic change occurred. The wood remains from Mount Carmel about 60–30 K years B.P. (Baruch, Werker and Bar-Yosef 1992) and 13–11 K years B.P. (Lev-Yadun and Weinstein-Evron 1994) indicate that the arboreal vegetation in Mount Carmel was for a long time almost of the same composition as today. Cultivation of *C. libani* in the coastal plain of Israel is very difficult even today with irrigation. Probably the winter is not cold enough and the summer too hot for a tree that grows where it snows every winter. Other *Cedrus* species establish better when planted. In addition, there is no indication of cedar planting in Israel in antiquity, but cedar trade is well documented (Lev-Yadun 1992; Mikesell 1969). Therefore, we conclude that *C. libani* wood remains are a clear indication of cedar trade. The imported items at Middle Bronze Age IIa Tel Nami reflect the role of this site and other Levantine coastal sites as "ports of call" along the sea route between Lebanon and Egypt, and relations with the greater international maritime trade network of the eastern Mediterranean (Artzy and Marcus 1991; Marcus 1991; Redford 1992). The cedar wood at Tel Nami is apparently a result of these relations. In addition, the preliminary report of cedar remains at Middle Bronze Age IIa Tel Ifshar (Porath and Paley 1993), a site that has produced both Egyptian pottery and Levantine Painted wares (Paley and Porath 1985), strengthens the notion of strong substantive contacts between the southern and northern Levantine littoral. These contacts continued as is shown by cedar remains at late MBIIb Kabri (Liphschitz 1992) and late MBIIb and LB Lachish (Ussishkin 1983).

We conclude that both types of botanical finds from this ancient port: (1) seeds of grapes, chickpeas, lentils and an imported Aegean legume *Lathyrus clymenum* L. (Spanish vetchling) (Kislev, Artzy, and Marcus 1993), and (2) wood remains of Aleppo pine, olive tree, kermes oak, Mt. Tabor oak and imported cedar of Lebanon as described here, represent a mixed economy of exploitation of both local resources and imports.

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APPENDIX

The anatomical characteristics used for the identification of the wood material from Tel Nami.

Cedrus libani, cedar of Lebanon (Pinaceae)

The cross-section showed that the wood was composed of tracheids and a sharp transition from late to early wood resulting in clear growth rings. No axial or radial resin ducts were found. The bordered pits had a fringed torus when seen in radial longitudinal section (Fig. 3–4).

Pinus halepensis, Aleppo pine (Pinaceae)

The cross section showed that the wood was mainly composed of tracheids and many nontraumatic axial resin ducts. One growth ring border was seen. In the tangential longitudinal section rays one and sometimes two cells wide, and radial resin ducts were found. The bordered pits seen in radial longitudinal sections were smooth and round (Fig. 5).

Quercus sp., oak (Fagaceae)

All oak species in the Levant, both evergreen and deciduous, have rays of two distinct sizes: uniseriate

and very wide multiseriate, which are sometimes aggregated (Fahn, Werker and Baas 1986). In our material, this characteristic was clearly seen (Fig. 6). The evergreen kermes oak, *Quercus calliprinos,* has diffuse porosity, while in the common deciduous oak of Mount Carmel, *Quercus ithaburensis,* the wood is ring porous. In some specimens of *Q. ithaburensis,* in our reference collection of recent trees, the arrangement of vessels as seen in the cross sections resembles that of *Q. calliprinos,* having a flame like pattern. However, when this occurs in *Q. ithaburensis* (Fig. 7), the flame-like groups of vessels are much wider than in *Q. calliprinos* (Fig. 8), which permits the distinction between the two species.

Olea europaea, olive tree (Oleaceae)

Growth rings are distinct in some specimens, and in others faint. The vessels occur in radial multiples or are solitary. Perforations are simple, usually with oblique end walls. The xylem is rich with thick-walled fibers. The heterogeneous rays are 1–3 cells wide, and usually 6–10 cells high (Fig. 9–10).