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**BIGLEAF MAPLE *ACER* CF. *MACROPHYLLUM* PURSH
(ACERACEAE) FROM EARLY PLIOCENE FLORA
OF HORTUN-1 (ARMENIA)**

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Based on morphological characteristics of leaves imprinted in clay formations of Hortun-1 locality (Armenia, Ararat region, Early Pliocene) a new species *Acer* cf. *macrophyllum* Pursh reported for the first time for Armenia.

Hortun-1 – Armenia – Acer cf. *macrophyllum* – *Early Pliocene – palaeoclimate*

ԶԶ Արարատի մարզում գտնվող բրածո բույսերի Զորթուն-1 տեղավայրի ստորին պլիոցենային հասակի կավային նստվածքներում դրոշմված տերևների մորֆոլոգիական հատկանիշների հիման վրա բերվում է Հայաստանի բրածո ֆլորաների համար նոր տեսակ՝ *Acer* cf. *macrophyllum* Pursh.

Զորթուն-1 – Հայաստան – Acer cf. *macrophyllum* –
վաղ պլիոցեն – պալեոկլիմա

На основании морфологических характеристик листьев, запечатленных в глинистых образованиях местонахождения Гортун-1 (Армения, Араратская область, нижний плиоцен), впервые для Армении приводится новый вид клена *Acer* cf. *macrophyllum* Pursh.

Гортун-1 – Армения – Acer cf. *macrophyllum* –
ранний плиоцен – палеоклимат

Geological sediments containing fossil flora belong to the third suite of the Yelpin series of West Vayots Dzor. In the Pliocene epoch in Armenia was dominated continental - lake mode, with the accumulation of powerful volcanic and freshwater-lake formations. In the tuffaceous rocks of Meotian-Pontian age of this formation meet fossil flora, which dates as a Early Pliocene [2, 4]. This locality is situated nearby the former village Hortun in Ararat region [1]. The total thickness of this formation exceeds 40-50 m. The lower interlayers with a thickness of 1-1.5 m, contain plant remains in a form of imprints of leaves and fruits of plants. There are also numerous imprints of insects.

The fossil flora was first studied by A.L. Takhtajan [13, 14] and N.G. Goghtuni [5, 6, 7, 8, 9, 10]. Later in the study of the flora was involved I.G. Gabrielyan [3] and A.S. Papikyan [12].

Materials and methods. The studied material include gatherings of 1946-2014 from Early Pliocene flora of Hortun-1 (more than 2100 samples). More than 230 specimens belong to the genus *Acer*.

The samples are kept in the Institute of Botany of NAS RA, in Palaeobotanical storage (ERE-PB). In order to determine the exact type of fossils the similarities and differences of leaves of modern and fossil species were studied. The imprints were compared with a leaves of modern species of maples kept in Herbarium of Institute of Botany (ERE) on the basis of Comparative Morphology method [23]. Fossil leaves were compared also with fossil and modern leaves of the other localities of Northern Hemisphere. For the description and measurement of leaves were used the methods widely used in Palaeobotany [17]. The data were developed statistically [11].

During the research were determined 73 imprints of Bigleaf maple imprinted on 65 samples. The state of preservation of fossil is various, some samples are almost complete. For the more detailed description were separated 5 of the most well-preserved samples including Γ -440a, Γ -590a, Γ -1102a, Γ -1107a, Γ -1118Aa.

Results and Discussion. *Acer cf. macrophyllum* is first brought for the fossil floras of Armenia.

Family *Aceraceae* Dumort.
Genus *Acer* L.
Acer cf. macrophyllum Pursh

Samples: Γ -31a, Γ -34a, Γ -37a/37Aa, Γ -92a, Γ -296a, Γ -425b, Γ -440a/ Γ -440Aa, Γ -441b, Γ -433Ab, Γ -444a, Γ -526b, Γ -585a/ Γ -585Aa, Γ -587a, Γ -588a/ Γ -588Aa, Γ -590a, Γ -590b, Γ -592a, Γ -593a, Γ -598a, Γ -601a/ Γ -604a, Γ -603a, Γ -605a/ Γ -605Aa, Γ -605b, Γ -607Aa, Γ -608d/ Γ -608Aa, Γ -619a, Γ -812a, Γ -1102a, Γ -1104a, Γ -1107a/ Γ -1107Aa, Γ -1108a, Γ -1108b, Γ -1110a, Γ -1110b, Γ -1116a/ Γ -1116Aa, Γ -1118b, Γ -1118c/ Γ -1118Aa, Γ -1123a/ Γ -1123Aa, Γ -1126a, Γ -1127a, Γ -1127b/ Γ -1127Aa, Γ -1129a, Γ -1136a, Γ -1139a, Γ -1141a, Γ -1256a, Γ -1198a, Γ -1198b, Γ -1516a, Γ -1553a, Γ -1560a, Γ -1564a, Γ -1602a.

It should be noted that Γ -296a, Γ -440a/440Aa, Γ -433Ab samples were previously been identified as *Acer platanoides* L. [7]. The lobes of this specimens are narrow at base, 2-3 big dentate, which is not typical for *Acer platanoides*.

General description of fossil leaves: Leaves rounded, ovate or broadly ovate, deeply 5-lobed, with cordate base. The lobes of mature leaves cuneate, narrow in base, and up to twice broader in the middle part. This is particularly well expressed in the central lobe. Specimen Γ -1102a 8.5 cm long (restored length 11.5-12 cm) and 13.8 cm width (restored width 16-17 cm). The restored length of largest leaf (Γ -1107Aa) 18-19 cm, width 23-25 cm. They have only 2-4 pairs of bluntish teeth in each lobe. General veins 1-1.5 mm thick, secondary and third veins 0.3-0.5 mm, lower class veins sharply differ in thickness. Secondary veins branch out from main veins at 40-45°. Third order veins well expressed. Fourth order veins create large alveols, in which ends the fifth class vein (without ramifying) (fig. 1).

Comparative remarks: Bigleaf maple (*Acer macrophyllum* Pursh), also called Broadleaf maple or Oregon maple, is one of the few commercial hardwood tree species on the Pacific Coast of North America. Most mature bigleaf maples are about 15-20 m. They have rounded crowns supported by short, branching boles if open-grown, but trees growing in dense stands and a trunk is free of branches for half to two-thirds of their height. The native range of Bigleaf maple extends from latitude 33° to 51° N, always within the area of 300 km of the Pacific Ocean [24].

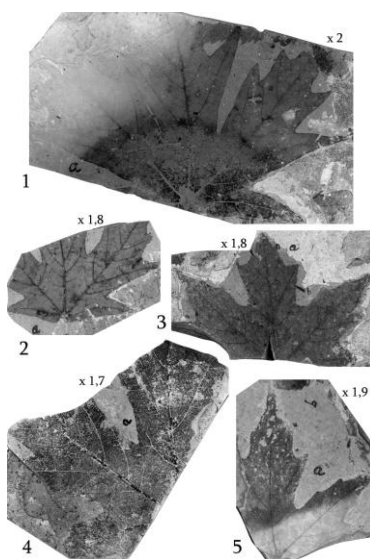


Fig. 1. 1-5 – *Acer cf. macrophyllum* Pursh, 1 – Γ '-1102a, x 2; 2 – Γ '-590a, x 1.8; 3 – Γ '-440a, x 1.8; 4 – Γ '-1107a, x 1.7; 5 – Γ '-1118Aa, x 1.9.

Leaves big, 5-lobed, up to 20-30 cm wide, with narrow-based, floppy lobes. Middle lobe mostly 3-lapping. Lobes with a few, large, blunt teeth, glossy dark green above, lighter below, hairy, rough, orange in autumn [20].

Bigleaf maple grows over a wide range of temperature and moisture conditions, from the cool, moist, marine climate of coastal British Columbia to the warm, dry, growing seasons of southern California. Bigleaf maple is often associated with springs, streams, and other permanent sources of water in southern California, but it also grows on eastern and northern slopes in California where more than 600 mm of annual rainfall occurs. Temperature probably limits the northern distribution of bigleaf maple. Bigleaf maple is associated with many soil groups, including the moist but well drained Brown Soils, Reddish Brown Lateritic soils, both fine- and coarse-textured dry soils and shallow, dry soils [22].

Thereby, morphological characteristics of fossil and modern leaves of Bigleaf maple generally coincide. However, have been observed some statistically significant differences, especially the larger sizes of modern leaves, which does not allow to determine fossil species without epithet "cf."

Based on the abovementioned can be concluded that the described species has features typical for the *Acer macrophyllum*, in result of which the fossil species has called *Acer cf. macrophyllum*.

D. Axelrod discuss the Bigleaf maple as a relict species [15]. Fossil Bigleaf maple until now has been described from Pliocene and Late Miocene layers of North America [18, 25] and Late Miocene layers of South-West China [23, 26]. As a relative of this species for the Middle Miocene layers is given *Acer oregonianum* Knowlton from N. America [19, 22]. The probable ancestor for the Early Miocene is considered *Acer merriami* Knowlton [29].

In the upper-Tertiary period in Caucasus it was quite widespread rich, sometimes subtropical forest vegetation such as modern vegetation of southern Japan, south-western China, and Atlantic states of North America, with preserved, however, relict elements of more ancient tropical flora species [13].

According to A. Bruch and I. G. Gabrielyan [16] the annual average temperature of the study area in the Early Pliocene was 13.3-15.7 °C, average annual precipitation 867-1151 mm, which is much warmer and wetter than today. Evidence of this claim is also presence of *Acer* cf. *macrophyllum* in these layers. Today the main botanical associations around this locality in Armenia are different formations of mountain steppes.

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