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THE CHRONOLOGY OF NEOLITHIC-ENEOLITHIC IN THE STEPPE ZONE OF THE VOLGA BASIN¹

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Abstract. Introduction. The steppe zone of the Volga basin is interesting in connection with the study of the Orlovskaya, Cis-Caspian, and Khvalinskaya cultures. These cultures have an important significance for the prehistorical archaeology of Eastern Europe. The Orlovskaya culture is characterized by the appearance of the most ancient ceramics in the region, early signs of domestication are connected with the Cis-Caspian culture but the earlier metal items were found in the Khvalinskaya culture. Together with the main features of these cultures, the important question is a determination of reliable boundaries of them. From 2007 more than 60 radiocarbon dates were obtained. The basis consisted of the materials of the Varfolomeevskaya site. The most of dates had been done on the organics from ceramics. That was under dispute. **Methods and materials.** During the last eight years, more than 30 radiocarbon dates were obtained on the different organic materials (charcoal, animal bones, and food charred crusts) from new open stratified sites – Algay and Oroschaemoe. This set of dates gave the possibility to develop a reliable chronological schema for the Neolithic-Eneolithic in the region under consideration. The comparison of dates on the different organic materials has been done. **Results.** The chronological framework of the Orlovskaya culture, the Cis-Caspian culture of transition period and the Eneolithic Khvalinskaya culture for the steppe zone of the Volga basin was determined. The place of the Orlovskaya cultural antiquities among of Neolithic cultures of neighboring regions was established. The age of transitional Neolithic-Eneolithic Cis-Caspian culture with the earliest pieces of evidence of domestication in Eastern Europe was definite. The chronological framework of the Khvalinskaya Eneolithic culture in the steppe zone was considered and made the comparison with the Cis-Caspian culture. **Authors' contribution.** A.A. Vybornov is prepared the archaeological part of the article and did analysis and their interpretation of the radiocarbon dates on the Neolithic of the steppe zone of the Volga basin. F.F. Giljazov collected all dates of the Orlovskaya culture of the Algay and Oroschaemoe sites. N.S. Doga did an analysis of dates of the Cis-Caspian and Khvalinskaya cultures on these sites. M.A. Kulkova obtained the

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radiocarbon dates for different layers of the Algay and Oroshaemoe sites and did the correlations on the different organic materials. B. Philippsen obtained the AMS dates on charcoal, bones, charred crusts and did their correlation.

Key words: the steppe zone of the Volga basin, chronology, radiocarbon dating, Neolithic, the Orlovskaya culture, the Cis-Caspian culture, Eneolithic, the Khvalinskaya culture.

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ХРОНОЛОГИЯ НЕОЛИТА – ЭНЕОЛИТА СТЕПНОГО ПОВОЛЖЬЯ¹

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Аннотация. Степное Поволжье представляет значительный интерес для исследователей в связи с изучением орловской, прикаспийской и хвалынской культур. Каждая из них имеет большое значение для истории первобытного общества Восточной Европы. Первая из них характеризуется появлением древнейшей керамики в регионе, вторая связана с ранними признаками производящего хозяйства, а третья демонстрирует наличие ранних металлических изделий. Помимо других аспектов для разработки этих древностей одним из приоритетных является установление достоверных хронологических границ каждой культуры. С 2007 г. накоплено более 60 радиоуглеродных дат. Основу составляли материалы опорной Варфоломеевской стоянки. Часть из них получена по органике в керамике, что придавало им дискуссионность. На двух новых стратифицированных памятниках в Саратовской области – Алгай и Орошаемое – за последние 8 лет сделано более 30 дат по различным материалам (уголь, кости животных, нагар). Этот массив позволил предложить более достоверную схему хронологии неолита – энеолита интересующего региона. Проведен сравнительный анализ дат, полученных по различным органическим материалам. Конкретизированы временные границы орловской культуры неолита степного Поволжья, прикаспийской культуры переходного периода и энеолитической хвалынской культуры. Определены хронологические рамки этапов и выявлено место орловских комплексов в системе неолитических культур сопредельных территорий. Установлен возраст переходной от неолита к эпохе раннего металла прикаспийской культуры, содержащей наиболее ранние в Восточной Европе сведения о domesticiрованных животных. Выявлена специфика временных параметров хвалынской энеолитической культуры степного Поволжья по сравнению с прикаспийской. *Вклад авторов.* А.А. Выборновым подготовлена археологическая часть статьи, проанализирован банк радиоуглеродных дат по неолиту степного Поволжья. Ф.Ф. Гилязовым обобщены все даты по орловской культуре стоянок Алгай и Орошаемое. Н.С. Дога проанализированы значения по прикаспийской и хвалынской культурам этих памятников. М.А. Кульковой получены радиоуглеродные значения для различных слоев стоянок Алгай и Орошаемое и проведено их сравнение по разным органическим материалам. Б. Филиппсен сделаны даты на АМС по углю, костям, нагару и сопоставлены с другими значениями.

Ключевые слова: степное Поволжье, хронология, радиоуглеродное датирование, неолит, орловская культура, прикаспийская культура, энеолит, хвалынская культура.

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Introduction. The steppe zone of the Volga basin is important for the study of the Volga-Ural region. Some innovations have occurred on this territory and they influenced the cardinal changes of prehistoric people's life. One of the fundamental problems of ancient history is the appearance of pottery. The most ancient ceramics in the region were connected with the carriers of the Orlovskaya culture according to the Varfolomeevskaya site research [27, p. 169]. In the later stage of development of this culture, according to some investigations, the earliest domestication was developed [26; 28, p. 8–9]. These data supported the previous results obtained in process of excavation of the Orlovka site located in the Volgograd area [25]. The third important innovation was the ancient metal production in the Khvalinskaya culture [2, p. 25]. These problems could not be developed just in the framework of the steppe zone of the Volga basin or the Volga-Ural region without the determination of reliable chronological boundaries between these cultures on the basis of radiocarbon dating. Before the appearance of these results, the researchers took into consideration the synchronization with import items or the dates of similar complexes from neighboring regions. However, these were indirect data and sometimes they did not correspond with archaeological periodization. This point of view was changed with the emergent of the first radiocarbon dates on the Orlovskaya Neolithic culture from the Varfolomeevskaya site and materials from the Khvalinskaya Eneolithic burial. In both cases, there were not so many dates and several from them were under question. In particularity, the dates for layer 2A (4500–4200 calBC) with the artifacts of the later stage of Orlovskaya culture were under discussion [28, p. 9–10]. Besides, materials of the Khvalinskaya burials were dated to 5000–4500 calBC [1, p. 86; 24]. According to these data, the Khvalinskaya Eneolithic culture was more ancient in comparison to the

Orlovskaya Neolithic culture. The dates on the Cis-Caspian culture were absent. The artifacts of the Cis-Caspian culture were found in the upper layer of the Varfolomeevskaya site and chronologically they must be later than 4200 calBC of this date obtained on the materials of the Orlovskaya culture. But such results were contradictory with archaeological periodization of Neolithic-Eneolithic of steppe zone of the Volga basin and neighbored regions.

From 2007 to 2013 the method of direct radiocarbon dating of organics from ceramics became used. The method was described as well in the foreign [5; 11] as domestic publications [21]. 19 radiocarbon dates were obtained for the Orlovskaya culture [4, p. 1252; 31, p. 215] and one date for the Cis-Caspian culture and one date for the Khvalinskaya culture [30, p. 115, tabl. 1,1,2]. The dates for the Cis-Caspian and Khvalinskaya cultures seemed reliable. The most of dates for the Neolithic are valid also. So, for layer 3 of the Varfolomeevskaya site the set of dates from 6250 to 5840 calBC corresponds to the date on charcoal (6250–5500 BC) obtained earlier.

The dates for materials from layer 2B correlate with the stratigraphy of the bottom cultural layer: 6020–5730 calBC. From 8 dates from the 2A layer, just two dates are valid because they are correlated with the dates of the bottom layer: 5630–5150 calBC. Other dates are older or too young. Probably, the older age of the material can be explained by prevailed shells of freshwater mollusks in pottery paste [3, p. 112–113], while the soils could influence on rejuvenation of ceramics. Such examples are known for ceramics of the Elshanskaya culture. Therefore, the dating procedure both the traditional method and the AMS technique was provided with using charred food crusts on pottery [6]. The dates on charred food crusts from the pottery of layer 2B were older (6350–5750 and 6220–5740 calBC) because of the reservoir effect. Two AMS dates have some differences.

The first date (6010–5830 calBC) has a good correlation with the dates on organics from pottery. The second date is a little younger (5816–5659 calBC) but it is older than the dates of the upper level and can be accepted. The dates of charred crusts on pottery from the layer 2A (5680–5330 calBC) have corresponded to the dates on organics from pottery (5630–5340 calBC). Almost all dates obtained on the Neolithic artifacts are reliable.

The correlation of dates of charred food crusts and organics from ceramics allowed us to conclude about the application of radiocarbon analysis for ceramic dating and validity of determinations [20]. On other hand, it needs the verification of results as well as a collection of radiocarbon dates for the Neolithic and especially for the Eneolithic. The excavations on the archaeological sites which were open in the last time give such possibility. The aim of this article is the analysis all radiocarbon dates obtained on these sites.

Methods and materials. From 2014 to 2021 two new sites of Neolithic and Eneolithic epochs are excavating in the steppe zone of the Volga basin. Algay and Oroshaemoe I sites are located in the Alexandrovo-Gayskii region of the Saratov oblast' [6; 32]. These sites are characterized by good stratigraphy with sterile layers that separate the cultural horizons. This gives the possibility to divide the horizons containing artifacts of the Orlovskaya, Cis-Caspian, and Khvalinskaya cultures [10, p. 189; 16, p. 69; 22, p. 378–380]. At the same time, the features of locations and the spreading of cultural layers at each site can be considered [17, p. 54–57]. 38 radiocarbon dates were obtained for these sites. Among them 20 dates on animal bones, 8 dates on charcoal, 3 dates on charred food crusts, 2 dates on ceramics, one on vertebras of fish. 8 samples were dated by the AMS method. For the lower level of the Orlovskaya culture on the Algay site there are 3 dates (Tabl. 1,2–4). They lay in the interval of from 6277 to 5810 calBC. The date of 6277–6230 calBC can belong to the Mesolithic period. The knifelike plate with retouch of the Seroglazovkii type on the abdomen, which can be attributed as the liner was found during the excavation in 2015 [7, p. 34, Fig. 17,9]. The Mesolithic cutters, scrapers, parallelogram,

plates that having a beveled end absent in the materials. The artifacts were found not inside of lower but inside of upper level. In this layer, the Neolithic trapeziums with chipped back have been revealed [7, p. 34, Fig. 17,15–16]. At the level of deposits located on the mainland from the excavations of 2016 the radiocarbon date obtained on humus acids from these deposits is ca.6270 calBC. In this layer, the Neolithic axe was found which is evidence of the non-Mesolithic age of this cultural layer [9, p. 65, Fig. 15,1]. Such kind earlier dates can be attributed to the Earlier Neolithic and it is supported by also two dates from the lower level of the Oroshaemoe site (Tabl. 1,26–27). The first date is ca.6227 calBC and it corresponds to the dates from the Algay site. The second is ca.6072 calBC from the upper level. This is the age of ending of an earlier period of people occupation at the site. This date has a correlation exactly with the date on charcoal (ca. 6200 calBC) from the third (lower) layer of the Varfolomeevskaya site. Another argument of the fact of this date belongs to the Early Neolithic is the specific find of corolla which lays in upper levels than these dates. The corolla has a thickness that appeared on the vessels of the Orlovskaya culture from layer 2A of the Varfolomeevskaya site.

In the excavation of 2014, the peripheries of the site have been studied. The thickness of layers in this part of excavation is not such large in comparison with the central part. Probably, the lack of the most ancient horizons could be explained by this fact. Such conditions were also observed at the Varfolomeevskaya site [29, p. 14–15] as well as at the Dzhangar site [23, p. 20–22]. The radiocarbon dates (5930–5614 calBC) obtained from the lower level of this part of the site corresponds to the formation of the 2B layer on the Varfolomeevskaya site. This is also supported by the date of 5933–5631 calBC from the upper layer at the Oroshaemoe site. The AMS date obtained on charred food crusts has a lower limit of ca.5741 calBC which is correlated with the date of the upper boundary of lower layers (5810 calBC). The date on charred food crusts is the same as the date of animal bones what is evidence of the absence of reservoir effect. All these data have a good correlation.

Table 1. The radiocarbon dates from the Neolithic and Eneolithic sites in the steppe zone of the Volga basin. Algay and Oroshaemoe I sites

№	Site	14C Date (BP)	Index of Labs	Calibrated date (calBC)	Material
1	Algay	7580 ± 46	AAR – 21894	1σ 6470-6410 2σ 6530-6360	vertebras of fish
2	Algay	7284 ± 80	SPb_2144	1σ 6240-6069 2σ 6271-6008	humus acid
3	Algay	7263 ± 100	SPb_3347	1σ 6227-6056 2σ 6277-5981	bone
4	Algay	7145 ± 100	SPb_3115	1σ 6101-5897 2σ 6230-5810	level 30, bone
5	Algay	6882 ± 100	SPb_3346	1σ 5846-5668 2σ 5930-5623	bone
6	Algay	6820 ± 80	SPb_1510	1σ 5772-5636 2σ 5889-5614	140 cm, bone
7	Algay	6800 ± 40	Poz – 65198	1σ 5722-5662 2σ 5741-5631	charred crusts
8	Algay	6654 ± 80	SPb – 1509	1σ 5640-5510 2σ 5710-5470	130 cm, bone
9	Algay	6605 ± 32	AAR – 21893	1σ 5565-5510 2σ 5620-5480	100 cm, charcoal
10	Algay	6577 ± 80	SPb – 1778	1σ 5570-5478 2σ 5641-5374	120–130 cm, bone
11	Algay	6540 ± 110	SPb – 2726	1σ 5572-5463 2σ 5667-5306	pottery
12	Algay	6490 ± 40	Poz – 76004	1σ 5450-5370 2σ 5530-5360	charcoal
13	Algay	6479 ± 70	SPb – 1477	1σ 5492-5368 2σ 5560-5316	100–110 cm, bone
14	Algay	6360 ± 250	SPb – 1411	1σ 5553-5035 2σ 5742-4723	110–120 cm, charcoal
15	Algay	6318 ± 33	AAR – 21892	1σ 5330-5280 2σ 5360-5210	100 cm, bone
16	Algay	6284 ± 100	SPb – 2038	1σ 5367-5205 2σ 5472-5018	bone, 90–100 cm
17	Algay	6245 ± 32	AAR – 21891	1σ 5300-5210 2σ 5310-5200	charred crusts
18	Algay	6200 ± 70	SPb_3360	1σ 5191-5047 2σ 5315-4986	bone
19	Algay	6205 ± 120	SPb_3348	1σ 5231-5003 2σ 5384-4843	bone
20	Algay	5955 ± 60	SPb_3345	1σ 4907-4781 2σ 4995-4711	bone
21	Algay	5875 ± 60	SPb_3359	1σ 4804-4681 2σ 4853-4583	bone
22	Algay	5875 ± 60	SPb_1968	1σ 4833-4687 2σ 4856-4580	70–80 cm, bone
23	Algay	5720 ± 120	SPb_1475	1σ 4710-4450 2σ 4840-4340	50–60 cm, bone
24	Algay	5846 ± 70	SPb – 3116	1σ 4792-4614 2σ 4851-4534	bone
25	Algay	5680 ± 80	SPb – 1476	1σ 4616-4447 2σ 4710-4359	60–70 cm, bone
26	Oroshaemoe	7245 ± 60	SPb – 2141	1σ 6210-6137 2σ 6227-6015	level 28, charcoal
27	Oroshaemoe	7010 ± 110	SPb – 2143	1σ 5992-5786 2σ 6072-5674	level 27, charcoal
28	Oroshaemoe	6889 ± 100	SPb – 2090	1σ 5883-5704 2σ 5933-5631	level 22–23, bone

End of Table 1

№	Site	14C Date (BP)	Index of Labs	Calibrated date (calBC)	Material
29	Oroshaemoe	6620 ± 100	SPb – 2854	1σ 5626-5485 2σ 5720-5461	level 40, charcoal
30	Oroshaemoe	6580 ± 100	SPb – 2853	1σ 5625-5472 2σ 5674-5338	level 39, charcoal
31	Oroshaemoe	6551 ± 40	Hela – 4005	1σ 5535-5478 2σ 5570-5469	level 31, charcoal
32	Oroshaemoe	5934 ± 100	SPb – 2091	1σ 4946-4703 2σ 5060-4547	level 10, bone
33	Oroshaemoe	5890 ± 120	SPb – 1729	1σ 4911-4611 2σ 5056-4462	pottery
34	Oroshaemoe	5806 ± 26	UGAMS-23059	1σ 4711-4615 2σ 4724-4557	bone of domestic sheep
35	Oroshaemoe	5716 ± 110	SPb – 2471	1σ 4692-4456 2σ 4796-4347	humus acids, 150 cm
36	Oroshaemoe	5520 ± 90	SPb – 2634	1σ 4459-4320 2σ 4552-4224	humus acids
37	Oroshaemoe	5667 ± 100	SPb – 1474	1σ 4610-4439 2σ 4725-4336	bone
38	Oroshaemoe	5328 ± 33	AAR – 26176	1σ 4240-4060 2σ 4252-4050	charred crusts

The chronological division between the middle and later stages of the Orlovskaya culture at the Algay site is the group of dates in the interval of 5640–5374 calBC (Tabl. 1,9–11). The dates were obtained on charcoal, bones, and ceramics and have a good correlation between them. A similar date on charcoal was determined on the Oroshaemoe site (Tabl. 1,31). This interspace corresponds also with the date from the 2A layer of the Varfolomeevskaya site. At the same time, there are some particularities. From deposits of level (100 cm), the samples of charcoal, bones, and charred crusts on ceramics were dated. The dates on bones and charred food crusts have good matching and they lay in the interval of ca.5360–5210 calBC, but the date on charcoal of 5600–5480 calBC is older (Tabl. 1,9). At the Oroshaemoe site, the radiocarbon dates from the levels of 39 and 31 have a good correlation but they are divided by the interval (Tabl. 1,30–31). Besides them, several dates from upper levels were obtained in the range of ca.5560–4986 calBC. The upper limit of one of the dates is 4843 calBC occurred because of the large uncertainty of 120 years and can not be accepted. At the same time, the upper chronological level of the dates obtained on the charred crusts on ceramics for the 2A layer of the Varfolomeevskaya site is ca.4950 calBC. There are some dates in the interval of 5300–4986 calBC

which had not been determined earlier both at the Varfolomeevskaya and the Algay sites. The sterile interlayer separates the layer of the Cis-Caspian culture. There are two dates of 4796–4347 calBC and 4552–4224 calBC which were obtained from the lower and upper soil horizon containing the artifacts at the Oroshaemoe I site (Tabl. 1,35–36).

They are a good correlation with the stratigraphy of the site. But they are characterized by wide intervals. The first date on ceramics is 5056–4462 calBC (Tabl. 1,33) with an uncertainty of 120 years. The date on bones of 5060–4547 calBC is matching with the date on ceramics. The AMS date on the domestic sheep is ca.4724–4557 calBC corresponding with the date on the lower soil layer. The dates on materials from the Algay site can be considered for comparison. During excavations in 2015–2017, the dates on bones from upper levels with materials of the Orlovskaya and the Cis-Caspian cultures had been obtained (Tabl. 1,22–23). They lay in the interval from 4856 to 4340 calBC. Such a wide interval is because of the uncertainty of 120 years. During excavation in 2019–2020 the age of bones from the Cis-Caspian layer has been defined (Tabl. 1,20,21,24). They are in the range from 4853 to 4534 calBC. One of the dates (4995–4711 calBC) is older than others but it has a good agreement with the set of dates on bones and

ceramics from the Oroschaemoe I site. So, a series of dates obtained on different organic materials from two sites allows establishing the reliable framework of the Cis-Caspian culture in this region from 4900 to 4600 calBC. In this context it is interesting the date of ceramics of the Cis-Caspian type from the Kumyska site, that is 5870 ± 70 BP (Ki – 16271) (4860–4540 BC) [30, p. 115, Tabl. 1,2]. This date is identical to the last dates. There also is the date of the charred food crusts on pottery of the Orlovskaya culture of 5800 ± 150 BP (SPb – 939) (5050–4300 calBC) from the upper layer of the Varfolomeevskaya site. The calibrated date lay in a wide range of meaning but it includes the interval of 4900–4600 calBC. This layer contents the ceramics of the Cis-Caspian type. Such chronology suggests some synchronicity of both cultures. But it is possible another interpretation. The presence of the Orlovskaya pottery inside of a layer of the Cis-Caspian horizon can be evidence of rejuvenation of the date because of humic acids from soil influence. The examples of the influence of humic acids of soils on the age of ceramics and bones are known at the Baibek site [8, p. 153].

In the upper levels at the Algay and Oroschaemoe I sites the artifacts of the Khvalinskaya culture were found. For this layer for the Algay site the date lays in the range of 4710–4359 calBC (Tabl. 1,25). At the Oroschaemoe I site the date is 4725–4336 calBC (Tabl. 1,37). On the other hand, there is an overlap of the lower boundary and upper chronological border of the Cis-Caspian antiquities. It can be evidence of a short chronological gap between these cultures. At the same time, there is a sterile interlayer between these cultural layers. The thickness of the interlayer is less than between the Orlovskaya and the Cis-Caspian cultural layers. The AMS date of the charred food crusts on pottery of the Khvalinskaya culture is 4252–4050 calBC (Tabl. 1,38). This date is younger and it also can be evidence that the Cis-Caspian culture is much older. In this connection, it should be considered yet another example. Several dates were obtained on the different organic materials for the 2A layer of the Varfolomeevskaya site. They lay in the interval from 4370 to 3950 calBC. These dates are contractionary with the chronological framework of the Orlovskaya culture. There is some discrepancy with the chronology of the Cis-Caspian culture. In this layer the copper plate has been found and that

A.I. Yudin is attributed with the Khvalinskaya culture [29, c. 161]. Therefore these data allow us to consider this date as belonging to the Khvalinsk period. The date on pottery of the Khvalinskaya culture from the Kumyska site is 5260 ± 80 BP (Ki – 16273) (4260–3940 calBC) [30, p. 115, Tabl.1,1] that can be another proof of it.

Results. Analysis of stratigraphy, typology of artifacts, and the set of radiocarbon dates obtained on charcoal and animal bones from both sites of the steppe zone of the Volga basin allows us to conclude firmly that the Neolithic period in this region began at 6270–6000 calBC. This earlier age was also supported by the results of the techniques-technological analysis of pottery that gives the possibility to characterize one of the ancient techniques of ceramic making [12, p. 13]. The period from 5900 to 5600 calBC is the middle stage of the Orlovskaya culture. In agreement with the data obtained the end of the Orlovskaya culture can be dated to 5500–5000 calBC. Such earlier chronological boundary can be traced in the materials of the Northern Cis-Caspian [14, p. 147], for example, for the Kelteminarskaya, Rakushechnoyarskaya, Surskaya [18, p. 18–19, Tabl. 1], and Elshanskaya cultures [19, p. 47]. The chronological framework of the development of these cultures may not be the same as the Orlovskaya culture what depends on the specifics of their dynamics. The Northern Cis-Caspian Neolithic finished at 5400 calBC, but in the forest-steppe zone of the Volga basin, the date of ending is 5500 calBC. The beginning of the Neolithic probably is dated at the same time in both regions.

The Cis-Caspian culture belongs to the transitional period from the Neolithic to Eneolithic [15, p. 69] and, in accordance to new stratigraphical, typological and radiocarbon data this period can be dated to 4900–4600 calBC. It is important not only in the question about the relation between the Orlovskaya and the Cis-Caspian antiquities. Regarding new data, the most ancient features of domestication in Eastern Europe were registered in the earlier Cis-Caspian culture in comparison to the Khvalinskaya culture [13, p. 365]. The bottom boundary of the Khvalinskaya culture is dated to 4700 calBC. Therefore, it is possible to suggest a linking of the most later Cis-Caspian complexes and the earlier Khvalinskaya stage. But the dates of the

Eneolithic culture relate to the later period (4600–4400 calBC). The presence of a sterile interlayer separating these layers is evidence of this.

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