ON THE PROVENANCE OF THE RED OCHRE FROM THE TOMB WITH RITUALLY CUT SKELETON OF VĂDASTRA (COŢOFENI CIVILIZATION)

GH. GÂŢĂ, CORNELIU N. MATEESCU

The first of the two main archaeological objectives aimed at *Vădastra* in 1970 was knowledge of the tombs of the *Coţofeni* civilization bearers (the transition period from Neolithic to Bronze age). The excavation of the hillock called 'at Drăgan' — 45 m to the west of Măgura Fetelor (Maidens' Hillock) — uncovered the hollow of a tomb dug in the middle of a Neolithic settlement. Its size was of 0.85 × 0.60 m and maximum depth 0.92 m from the soil surface. Deep in the hollow there were the remains of the ritually cut skeleton of an adult woman, 16—20 years old ; a little upward, there were the remains of the skeleton of a child, *Infans II*, whose little bones were, most of them, decomposed [1]. The tomb was part of a small cemetery of the Coţofeni civilization bearers; in the same place, towards late 14th century, our era, Romanians were also buried; later, in the 17th—18th centuries, the hillock was again inhabited. More than half a century ago, by the building of the Drumul Morii (The Mill Road) a few tombs on the hillock were destroyed and, in 1952, more tombs, that belonged to the Coţofeni civilization bearers and the Romanians of the 14th century, were destroyed by a brick yard which had just been built there [2].

As the picture shows, the skeleton of the adult is relatively well preserved. Near its skull cap and among the fragments of the child's little bones, a few small grains of red ochre [3], dark cherry-coloured in hue (1.42 g) were found there; faint spots of red ochre were found also on the woman's skull (plate 1). The cut skeleton of the adult had been the object of several communications and studies [4]; the present paper deals only with the provenance of the red ochre found in the tomb.

SAMPLES INVESTIGATED

The ochre samples discovered at Vădastra in tombs of the Coţofeni civilization were analysed together with other ochre samples taken from various localities nearer or farther from the abovementioned place (plate 2/1). For clarity and simplification, the samples were denoted by letters and indices : the archaeological samples were denoted by letter A, the lithologic samples analysed as presumed ochre sources — by letter S, and the samples analysed to specify a possible contamination of the ochre samples from the tombs — by letter C. Thus, the following samples were analysed :

A_1 — red ochre from the south of the woman's skull (Vădastra, 1970);

A_2 — red ochre from the south of the child's skull;

A_3 — red ochre from tomb III (Coţofeni civilization), discovered at Măgura Fetelor (Vădastra, 1965);

[1] Corneliu N. Mateescu, Materiale, 10, 1973, p. 19, 22 :

[2] Corneliu N. Mateescu, SCIV, 6, 1955, 3—4, p. 452—453.

[3] Corneliu N. Mateescu, Materiale, *op. cit.*, p. 23.

[4] Sylviu Comănescu, Horia Dumitrescu, Corneliu N, Mateescu, Dacia, 25, 1981, p. 34 and note 4,

A_4 — red ochre from the head of a large figurine of Vădastra II phase, middle Neolithic[5] (Vădastra, 1946);

A_5 — red ochre from various decorated clay vases of Vădastra II phase, mixed sample;

AC_1 — soil sample from upon the cut skeleton (Vădastra, 1970);

AC_2 — soil sample from the depth of 1.45 m, Vădastra I layer (Vădastra, 1970);

AC_3 — soil sample from the depth of 1 m, Vădastra II layer (Vădastra, 1973);

C_4 — B_2 horizon (90—110 cm), leached chernozem profile (Vădastra, 1981);

C_5 — B_2 horizon (90—110 cm), leached chernozem profile (Studina, 1981);

C_6 — C_2 horizon (85—105 cm), chernozem profile (Orlea, 1981);

S_1 — red clay from the steep border of Balta Obîrşia (Obîrşia Swamp), near the dam of the mill ruins (Vădastra, 1982);

S_2 — reddish-brown clay from the close vicinity of S_1 sample;

S_3 — lehm (Cruşovu, 1982);

S_4 — lehm (Grădinile, 1982);

S_5 — lehm (Orlea, 1974);

S_6 — ferruginous concretions (Zăvalu, 1976);

S_7 — villafranchian clay-loam[6] (Segarcea, 1974);

S_8 — villafranchian clay-loam (Podari, 1976);

S_9 — villafranchian clay (Bucovăţ, 1980);

S_{10} — red clay-loam (Sălcuţa, 1974);

S_{11} — rendzina clay (Pescari, Caraş-Severin county, 1972).

The lithologic samples were selected upon colour so that their colour on Mansel scale[7] should fall within the interval of ochre samples discovered in tombs and that applied on the pottery of Vădastra II layer. The soil samples used for comparison with those taken from the ritually cut skeleton were chosen to assess the chemical composition of some Vădastra samples as against the chemical composition of the equivalent samples from the nearby localities.

ANALYTICAL METHODS

In the ochre samples and in the selected lithologic samples the calcium carbonate content was determined by infra-red absorption on the bands from 880 cm^{-1} and from 1430 cm^{-1}[8]. The chemical analysis was performed by fusion with perchloric acid and hydrofluoric acid[9]. Sodium and potassium, were determined by flame photometry and magnesium, calcium, strontium, aluminium, iron, manganese, chromium, cadmium, nickel, cobalt, zinc, lead, and copper by atomic absorption[10].

To compare the samples, linear correlation was performed between the analysed results of the ochre samples from the above-mentioned Vădastra tombs and the results of the lithologic samples. Thus, in a regression equation $y = mx + n$, x represents the results of the samples presumed as source, and y the results of the tomb ochre samples (plate 2/2). Accumulation of carbonates at the C horizon level (90—145 cm in the region's chernozem and leached chernozem) required correction of the calcium value by subtracting an amount of calcium equivalent to the carbonate content determined by infra-red absorption.

At the same time, in plate 2/2 the value of each element was conventionally balanced by factors proportional to the distribution of that element at C horizon level for a medium texture

[5] According to C^{14} analyses performed at NIAS Institute — Holland through the kindness of Mrs. Marija Gimbutas, the final date of Vădastra II phase is 4260 ± 80 years B.C. As to the Coţofeni civilization, the data obtained by C^{14} analysis are contradictory and no digging so far allows for a sure conclusion. According to more recent research work, the Coţofeni civilization covers the second half of the 3rd millennium B.C. (P.I. Roman, *Cultura Coţofeni*, Bucureşti, 1976, p. 67). In our opinion, however, this dating is too late. In the diggings made at Vădastra, the Coţofeni layer was destroyed in the course of time and the tombs discovered cannot help establishing an absolute chronology of the Coţofeni civilization.

[6] The term clay-loam is used in textural sense for a deposit with heavy texture (over 40% clay fraction).

[7] Mansel scale is a colour code adopted by the seventh approximation of soil classification in the U.S.A. to reduce subjectivism in assessing the colour of a soil. A code of figures and letters is used for colours. For example, the clay loam of Segarcea has the colour 7, 5 YR/4.

[8] Gh. Gâţă, Elena Gâţă and C. Schramek, Analele Institutului de Cercetări pentru îmbunătăţiri funciare şi Pedologie. Seria Pedologie, 1 (35), 1967, p. 153—160.

[9] The chemical analyses were performed by a variant of the method advanced by M. L. Jackson, *Soil chemical analysis*, London, 1958, p. 283—298.

[10] The analyses performed by the modern technique of adjuvant sciences can be a guide for Dacia and South-East Europe with a view to achieve a synthesis on the ochre, meant to help solving some archaeological problems (roads, relations for exchanges, influences exerted on the populations encountered, a.s.o.).

and depending on the profile variations of that element[11]. Table 1 shows that the analytical results of the microelements with small variations at the depth horizon level of a leached chernozem profile at Vădastra, justify the conventional utilization for such correlations of the microelements expressed by ppm and of the macroelements content expressed by percentage. As to manganese, which has the most marked mobility in the profile[12], the factor 0.1 was used for its values expressed by ppm.

Table 1

Horizon		B_1 70–85 cm	B_2 89–110 cm	C 115–135 cm
Content in ppm	Cu	15	14.7	13.5
	Pb	17	11.7	10.6
	Zn	47	49.8	49.6
	Co	12.2	12	11
	Ni	40	39.5	30
	Cd	1.08	0.55	0.6
	Cr	55	52.7	55
	Mn	470	374	320
Content in %	Al	5.71	3.3	2.7
	Fe	2.25	2.08	1.9
	Ca	0.62	0.53	8.24
	Mg	1.23	1.34	2.56
	K	0.56	0.50	0.43
	Na	0.05	0.05	0.04

The correlation coefficient of each regression equation was considered a measure of the probability of identity in the two samples compared. The more marked the similarity and its nearing the identity at $r = 1$ limit[13], the higher the value of the correlation coefficient. Because of the analytical errors the limit is not reached and the duplicate sample correlation leads to coefficients of over 0.997 *** (table 2). In this case, the regression equation of the two analyses is very close to the equation of bisectrix $y = x$.

Table 2

Samples	$A_1 - A_1$	$S_1 - S_1$	$S_2 - S_2$	$AC_1 - AC_1$	$AC_2 - AC_2$	$S_5 - S_5$
r	0.999	0.998	0.996	0.997	0.999	0.999

RESULTS OBTAINED

All the correlation coefficients of table 3 were calculated upon the chosen statistical criterion. Inscribed in columns, there are the values of the coefficients referring to the same archaeological ochre sample and on the lines there are the values of the coefficients of the same lithologic samples presumed as sources. The indices of the lithologic samples were selected so as to increase in step with the distance from the place of the above-mentioned Coțofeni tombs.

The data presented point out that the similarity of the samples, as resulting from the statistical calculus, decreases in the sequence S_1, S_2, S_6, S_7, S_{10}, S_{11}, S_9, S_8, S_4, S_3, S_5 for A_1 ochre, a sequence that is maintained with similar values for A_2 ochre, as well, except the pairs S_6 and S_7.

[11] N. C. Cernescu and Florica Popea considering the relation between the content of the complexes of van Bemmelen-Hissink in the forest reddish-brown soil and the depression podzol of Snagov, showed that the relative levigation of the various components occurs in the series $P_2O_5 - TiO_2 - SiO_2 - Al_2O_3 - Fe_2O_3 - K_2O - MgO - CaO - Na_2O - MnO$ proportionally with the row of numbers 1–9–19–20–31–34–38–60–75–77, Buletinul Facultății de Agronomie, 4, 1945, p. 9.

[12] According to N. C. Cernescu and Florica Popea, manganese has the most marked relative levigation, *ibidem*. p. 9.

[13] $r = 1$ represents the maximum value of the correlation coefficient when the two rows of values are proportional.

The correlation coefficients obtained for A_3 ochre are conspicuously more reduced than the coefficients for the other two samples investigated for the comparison with S_1 and S_7 clay samples and, obviously more increased for the comparison with the S_3, S_4 or S_5 lehm or loess samples.

Table 3

Samples	A_1	A_2	A_3	A_4	A_5
S_1	0.928	0.917	0.864	0.937	0.951
S_2	0.916	0.904	0.812	0.916	0.934
S_3	0.752	0.744	0.979	0.746	0.802
S_4	0.766	0.771	0.788	0.759	0.794
S_5	0.687	0.696	0.777	0.742	0.726
S_6	0.887	0.861	0.812	0.867	0.844
S_7	0.882	0.867	0.838	0.969	0.811
S_8	0.793	—	—	0.803	0.811
S_9	0.804	0.812	0.817	0.799	0.805
S_{10}	0.863	0.842	0.821	0.875	0.888
S_{11}	0.817	0.837	0.822	0.811	0.794

The A_4 ochre sample from the head of a large figurine of Vădastra II phase, very much like the A_5 mixed sample of ochre applications from several fragments of pottery belonging to the same phase represented at Vădastra, each of them being characterized by a limestone content under 12 %, present the highest values for the S_1 and S_2 lithologic samples. Except A_3 sample, it results that both the ochre discovered in the tombs of the Coțofeni civilization bearers and the ochre applied on most of the pottery discovered in the Vădastra II layer of Vădastra are resembling, being most similar also with the S_1 and S_2 red clay samples from the border of Balta Obîrşia near the dam of the mill ruins. This results from the fact that only in these cases the correlation coefficients exceed the value of 0.92 [14].

The difference among most of the archaeological samples of ochre and of A_3 ochre suggest that there are two ochre sources or that there is a contamination of this sample by the soil fallen into the tomb during burial. The soil sample from the cut skeleton of Vădastra could characterize the contamination source, but this sample as well could be impure due to either oil mixture during digging of the tomb, or the pedogenetic processes occurring at this level (C horizon) in Vădastra soil : accumulation of carbonates, migration of iron and manganese oxides hydrates, etc.

To demonstrate which of these two hypotheses reflects reality, it is necessary to know the profile variations of Vădastra soil and the differences between the various horizons of some soils in the region. If we correlate the analytical results of the soil sample from the skeleton with soil samples from some horizons of approximately the same depth (table 4), we observe high values

Table 4

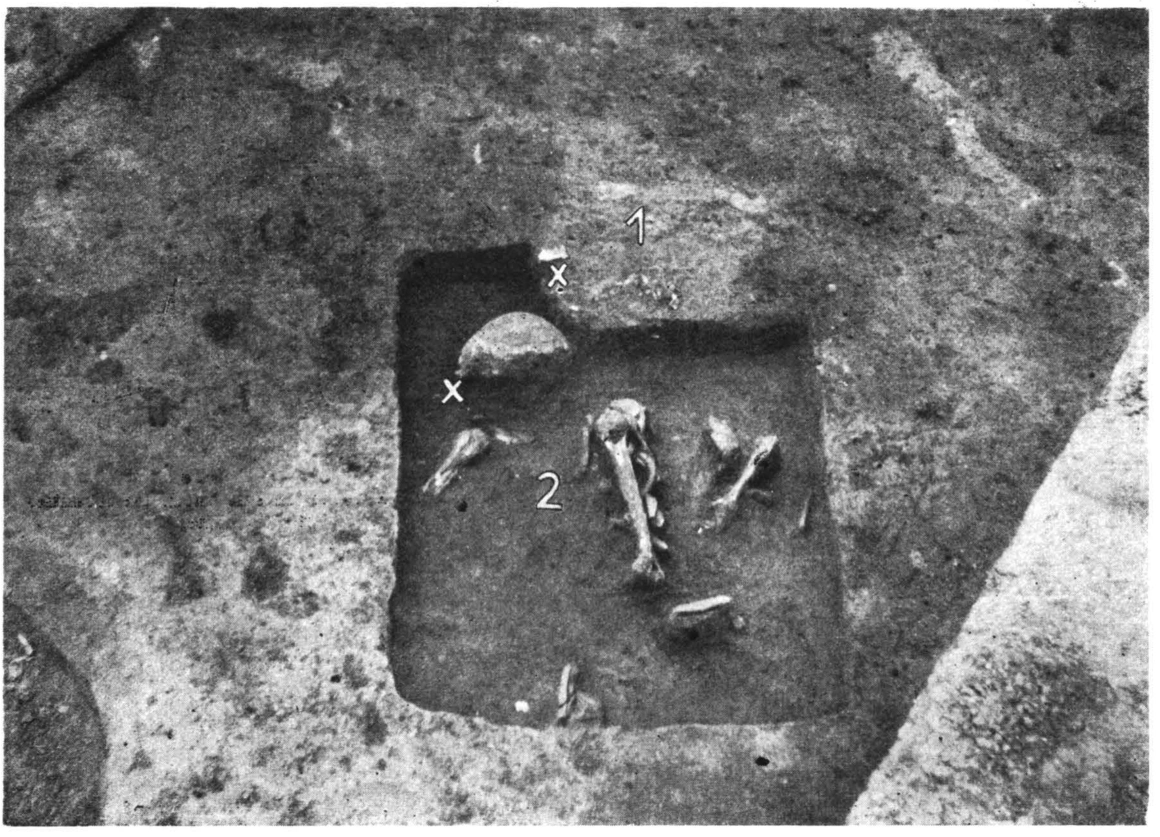
Samples	AC_2	AC_3	C_4	C_5	C_6
AC_1	0.998	0.997	0.995	0.992	0.989

of the correlation coefficients. It emerges that all these samples are very similar with the soil sample from the skeleton and that the variation of the chemical composition at a depth of 0.80—1.50 m is relatively reduced. Moreover, the values of the correlation coefficients between the chemical composition of the soil sample from the skeleton and of the S_1 ochre with a soil sample of Vădastra II layer and two lehm samples of the region (table 5) confirm the similarity of the two soil samples and exclude the lehm samples as ochre source by their correlation with the S_1 red clay.

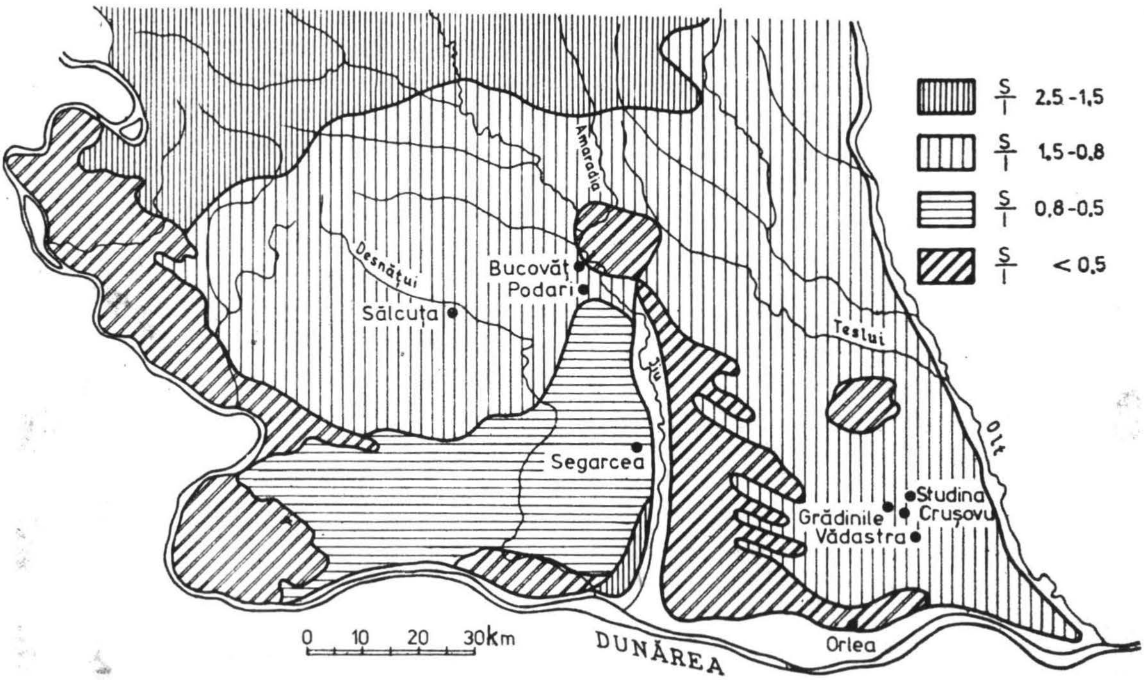
It results from these comparisons that A_3 may be an ochre sample of A_1 type but contaminated with AC_1 type soil, similar to the soil of the settlement of approximately the same depth

[14] The value of 0.92 is arbitrarily taken because it represents a mean limit value characteristic of Vădastra region,

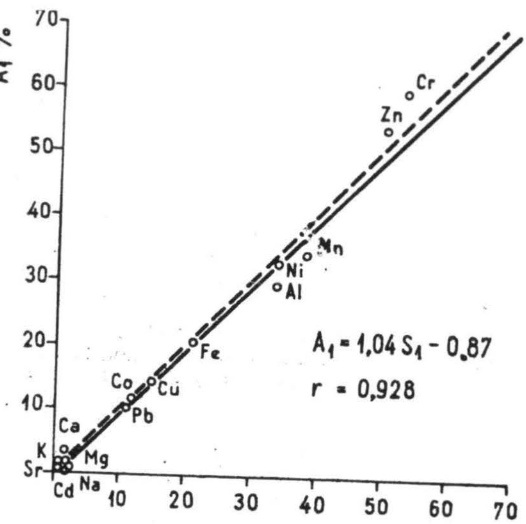
PLATE I



Vădastra. Tomb hollow with : 1. the skeleton of a child ; 2. the skeleton of an adult, cut according to a ritual procedure ; x. grains of red ochre, dark cherry-coloured in hue (Phto C.N.M.).



1. Map of clay minerals distribution in the lithologic soils and formations of south Oltenia, with the localities wherefrom the analysed lithologic samples were collected (S = smectite ; I = illite).



2. Distribution of the chemical compounds of an archaeologic sample depending on the compounds of a lithologic sample presumed as source.

(AC_2 and AC_3 samples). In this case we can calculate each chemical compound of A_3 ochre with the help of the chemical compounds of A_1 ochre and of AC_1 soil using the formula $A_3 = A_1(1 - k) + AC_1k$, where k represents the AC_1 contamination fraction of A_3 sample. By successive approximations, giving k various values, information can be obtained with respect to the extent to which ochre was contaminated by soil. In table 6, k is given the values 0.05 and 0.1, respectively, and then the corresponding correlation coefficients are calculated. It can be seen that for the mixture of 95 % A_1 and 5 % AC_1 (soil sample from the cut skeleton), the correlation coefficient with A_3 is 0.991. Hence, the three ochre samples from the above-mentioned tombs are identical, the A_3 sample being, however, contaminated by some 5 % soil of the soil-type found on the skeleton, very similar with the soil of the settlement (C horizon, AC_2 or AC_3 sample) [15].

Table 5

Samples	AC_1	S_1
AC_2	0.998	0.647
S_4	0.868	0.762
S_5	0.872	0.693

Table 6

Contamination	A_1	$A_1 + 0.05\ AC_1$	$A_1 + 0.1\ AC_1$
A_3	0.926	0.991	0.974

CONCLUSIONS

From the results presented, it was concluded:

— The A_1 and A_2 ochre samples are identical, while A_3 represents an A_1 sample mixed with some 5 % AC_1 soil from the skeleton, similar to the soil of the settlement from approximately the same depths.

— The S_1 and S_2 red clay samples from the steep border of the Balta Obirşia near the dam of the mill ruins *represent the source of the red ochre found in the tombs of the Coţofeni civilization bearers of Vădastra*, because the values of the correlation coefficients of the comparison equations are over 0.92.

— Correlation of the analysed ochre samples from most of the pottery of Vădastra II layer of Vădastra with the S_1 and S_2 samples (red clay and red dish-brown clay from the steep border of Balta Obîrşia) *specifies that the source of the ochre applied on this pottery is the red clay from the border of Balta Obîrşia.*

— The similarity of the ochre from the pottery of Vădastra II layer with the ochre from the tombs of the Coţofeni civilization points to the continuity in using S_1 and S_2 sources from Middle Neolithic to the Coţofeni civilization.

— The value of 0.92 estimated as similarity limit in investigating the sources of the ochre from the Coţofeni civilization tombs discovered at Vădastra depends on the lithologic substratum and on the alteration degree of the deposits in the region, and it cannot be generalized to other settlements.

[15] The analyses and determinations underlying the tables and the final conclusions were performed by Gh. Gâţă of the Institute of Soil Science, Bucharest.