Preliminary Analyses of Southern French Flint Samples

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(Voorgedragen door A. Phillips)

Introduction

In recent years, attempts have been made to characterise major sources of flint artifacts using methods of element concentration analysis. Sieveking and his colleagues (1) have employed atomic emission and absorption spectrometers whilst other workers (2, 3) have applied neutron activation analysis to the problem. Both approaches have had some success in 'fingerprinting' major sources in England, France and the Netherlands. However, when the experiments have been extended to artifacts from related archaeological sites, considerable difficulties have been encountered in assignments to the major sources. It is evident that flint is not homogenous in its trace element composition to the extent that a major geological programme of multi-element analyses is required before large scale assignments of flint artifacts may be contemplated. There remains the possibility, however, that well isolated flint sources may be characterised in such a way that the use of products from them on local archaeological sites may be recognised. This paper presents preliminary results of an investigation into flint sources in the Rhone Valley near Orange, Vaucluse, conducted jointly by the Universities of Bradford and Sheffield.

Location

The initiative was provided by excavations of an open-air Middle Neolithic site in the commune of Orange, Vaucluse (Chasseen culture, middle fourth millennium b.c.). The site, which consists of a layer of cultural debris associated with cobble structures and at least one cooking pit, was heavily disturbed by ploughing, and many artifacts were brought up to the surface and collected by the farmer. The majority of these finds were worked flints.

Some five kilometres to the South of the site is the small town of Châteauneuf-du-Pape, where a number of the famous vine-yards are planted in apparently soil-less fields crammed with nodules of flint and quartzite cobbles, some of the latter hafted in antiquity and used as hammerstones. Finds of there hammerstones on archaeological sites in the surrounding region suggest exploitation at least since the Chalcolithic (post 2500 b.c. in this area) (4). On the geological map (Avignon XXX-41 at 1/50,000) the outcrop of transitional facies Upper Barremien which produces the flint is widely represented to the North-West over an area called Le Lampourdier, now heavily damaged by removal of material for motorway construction.

To the East of Orange, some 25 to 30 kilometres away as the crow flies, are the flint 'mountains' of Vaux-Malaucène. Waisted hammerstones occur on the slopes of these hills also, and excavations in the 1960 's by Schmid revealed traces of prehistoric working of the limestone encasing the flint, six metres below the present surface (5, 6). A small rock-shelter on one hill-side, presently under excavation by M. Vincent, has revealed Chasseen pottery associated with a large flake industry on the local flint (Vincent, personal communication).

Experimental Method
Small fragments, ranging in mass from 170 to 750 mg were struck from flint specimens taken from the source sites of Châteauneuf-du-Pape, Le Lampourdier and Vaux-Malaucène. A limited number of samples were used in this preliminary study as follows. Four modular fragments were taken from Châteauneuf, two specimens from Le Lampourdier and five samples from three pieces of flint from Vaux. Twelve samples from the archaeological site were chosen from amongst the surface collections and the **in situ** material. All the samples were cleaned of surface contamination and then irradiated for approximately 70 hours in a thermal neutron flux of 6 x 10^{13} cm^{-2} sec^{-1} at the Herald reactor of A.W.R.E. Aldermaston. The time interval between irradiation and analyses amounted to several days so that only radioactive isotopes with half lives greater than two days could be adequately assessed. Analysis was carried out using a large volume Ge-Li detector associated with a 1024-channel analyser and the element concentrations were evaluated using computer programme SPEC evolved at Bradford. It is characteristic of flint that 'trace' elements are generally present at very low concentration levels compared, for example, with pottery or obsidian. In the event, quantitative estimates were made of sixteen elements using a composite powdered pottery standard provided by Perlman (7) as a reference.

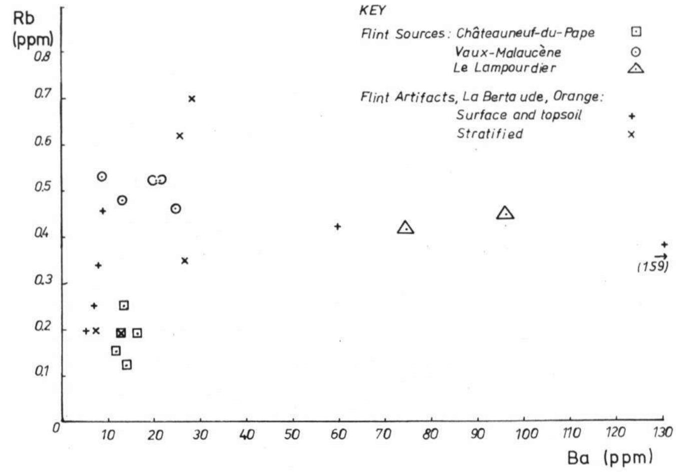

Fig. 1

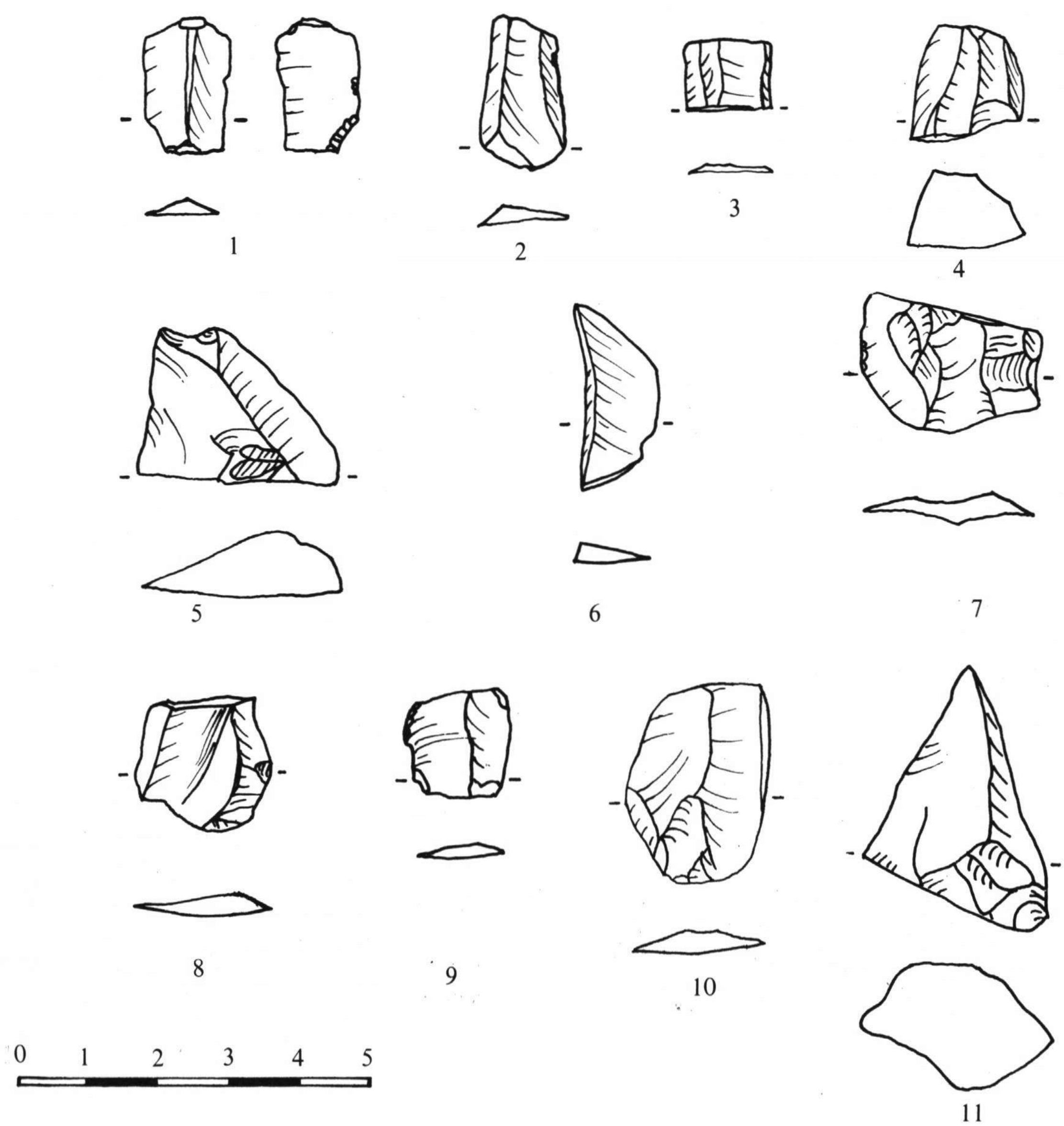

Fig. 2

ORANGE FLINT ANALYSIS

TABLE 1 (a)

Run	Ref. No.- (Source (Site	Sc	La	U	Sm	Fe	Co	Sb
		Element p.p.m.						
324/23	CHAT.d.P. 1A1	0.149	0.52	0.9	0.03	380	0.093	0.33
324/22	" " " 1A2	0.082	3.06	2.4	0.22	278	0.031	0.53
324/25	" " " 1A3	0.101	0.99	1.5	0.09	219	0.033	0.32
324/29	" " " 1AB4	0.087	8.70	2.3	2.3	151	0.025	0.66
324/27	LE LAMPDR.2A5	0.125	9.85	5.8	0.26	610	0.214	0.92
324/24	" " 2B6	0.117	12.10	8.7	1.20	610	0.208	0.99
325/29	34 VAUX VI	0.109	1.05	0.5	0.33	262	0.016	0.35
325/30	" " V2	0.047	2.48	1.2	1.14	145	0.081	0.53
325/31	" " V2	0.061	2.90	1.1	0.23	142	0.035	0.41
325/28	" " V3	0.128	1.29	0.2	?	211	0.051	0.15
325/33	" " V3	0.120	1.11	0.3	0.791	320	0.034	0.37

ORANGE FLINT ANALYSIS

TABLE 1 (b)

Run	Ref. No.- (Archaeological (Site	Sc	La	U	Sm	Fe	Co	Sb
		Element p.p.m.						
325/34	La Bertaude A31 B16 (Plough)	0.068	0.87	0.3	0.41	223	0.038	0.16
325/23	" " A28 B13 (Plough)	0.070	0.94	0.3	0.49	598	1.020	0.39
325/23	" " 284 A27B6 (Arch.)	0.062	1.15	0.4	0.18	191	0.092	0.15
325/22	" " 145. A33 B11 (Arch.)	0.611	4.86	0.8	?	500	0.144	0.90
325/32	" " (Gen.Surface A)	0.063	3.17	0.6	0.56	91	0.039	0.41
325/25	" " (" " B)	0.226	6.95	0.5	?	428	0.122	0.06
325/27	" " A27 B6 (1) (Plough)	0.068 0.068	0.31	0.1	0.35	410	0.131	0.29
324/28	" " A23 B6 (Plough)	0.088	0.84	1.6	0.001	250	0.034	0.12
324/26	" " A25 B6 (Plough)	0.141	0.64	1.2	-	864	0.111	0.13
324/21	" " 148A 33 B1 (Arch.)	0.308	2.55	2.1	-	501	0.154	0.24
324/20	" " 164 A26 B7 (Arch.)	0.118	1.84	2.0	0.05	391	0.093	0.19
324/31	" " 244 A58 B3 (Arch.)	0.146	5.55	1.9	-	496	0.094	0.17

Eu	Cs	Ce	Hf	Cr	(arb.) Tb*	Ta	Th	Rb	Ba
0.006	0.010	0.12	0.036	3.8	0.015	0.007	0.099	0.25	13
0.002	-	0.10	0.026	1.3	0.005	0.004	0.042	0.15	11
0.004	0.008	0.09	0.037	2.5	0.010	0.003	?	0.19	16
0.002	-	0.12	-	1.0	0.004	0.002	0.040	0.19	13
0.004	0.015		0.073	2.8	0.015	0.010	0.176	0.41	74
0.006	0.010	0.15	0.080	2.0	0.017	0.010	0.197	0.44	96
0.003	0.012	0.16	0.036	0.3	0.005	0.005	?	0.46	24
0.001	0.011	-	0.025	0.4	0.005	0.005	0.049	0.52	21
0.003	0.009	0.50	0.026	0.6	0.003	0.007	0.066	0.52	20
0.007	0.030	0.22	0.110	1.9	0.007	0.010	0.098	0.48	13
0.005	0.025	?	0.046	1.5	0.007	0.010	0.093	0.53	8

Eu	Cs	Ce	Hf	Cr	Tb*	Ta	Th	Rb	Ba
0.002	0.016	-	0.025	1.1	0.005	0.006	0.051	0.26	7
0.002	0.014	-	0.037	0.8	0.005	0.007	0.053	0.34	6
0.002	0.010	-	0.016	1.4	0.003	0.005	0.037	0.20	7
0.012	-	?	0.007	1.4	0.010	0.011	0.103	0.70	28
0.003	0.002	0.38	0.018	1.2	0.003	0.004	0.032	0.12	12
0.067	0.013	-	0.006	2.6	0.036	0.013	0.139	0.46	9
0.003	0.009	-	0.038	0.8	0.006	0.007	0.073	0.20	5
0.004	0.029	-	0.040	2.0	0.011	0.008	0.091	0.38	159
0.010	0.007	-	0.203	1.5	0.027	0.009	0.25	0.42	60
0.002	-	0.13	0.022	1.9	0.004	0.004	0.045	0.19	13
0.004	0.019	-	0.055	3.2	0.014	0.010	0.106	0.62	25
0.008	0.016	-	0.132	1.7	0.017	0.009	0.131	0.35	26

A further element, terbium, was measured on an arbitrary scale in the absence of an appropriate standard. The low concentrations of some elements present gave rise to considerable variations of accuracy of measurement. The elements scandium, iron, cobalt and lanthanum gave the most reliable values, being accurate to about 5% whilst others such as rubidium and barium could have concentration errors of up to 20%. At the extreme, antimony, cerium and europium were estimated to have approximately a 25% error.

Results and Discussion

The concentrations of elements in all source and the archaeological site samples are given in Table 1 (a) and (b). For the source specimens, immediate observations may be made. Firstly there is a considerable inhomogeneity for a particular element amongst samples from a given source. The mean value of scandium for the Châteauneuf source is 0.105 p.p.m. with a range from 0.082 to 0.149, roughly 60% overall. Caesium ranges from 'not detected' (approximately 0.001 p.p.m estimated from counting statistics) to 0.01 p.p.m. Even within two fragments from the same initial specimen such as Vaux (V3), variations of iron concentration of 50% are encountered. This inhomogeneity is in keeping with that found in flint from English and other European sources (2). The second observation, however, is that the two samples from Le Lampourdier differ from those from other sources in many respects. Lanthanum, uranium, iron, cobalt, antimony, thorium and barium are all present in significantly higher concentrations. Vaux and Châteauneuf specimens are generally similar to one another, but the alkali elements rubidium and caesium may be used as discriminating factors. The source discrimination obtained is illustrated in Fig. 1 where the rubidium and barium concentrations are graphed. Obviously conclusions can not be drawn with great confidence without adequate statistical treatment; this awaits the analysis of many more source samples.

Result for the archaeological site specimens are shown in Table 1 (b). Once again considerable variations in element concentrations can be seen. When the rubidium - barium values are inserted on Fig. 1 there appears to be a predominance of points which may be associated with the Châteauneuf or Vaux sources. Two specimens from the plough soil level are not readily associated with a source, although one might infer that the high barium content identifies with Le Lampourdier flint. However, examination of the other elements 'fingerprinting' that site does not greatly strengthen it as the source of the two archaeological samples.

On the basis of these preliminary results, we may suggest the hypothesis that the Châteauneuf-du-Pape source, at least, was exploited by the Middle Neolithic visitors to the Orange site. Four of the flint tools from the Orange site and possibly emanating from this source were of the famous honey colour so frequently found in Chasseen assemblages throughout Southern France.

The archaeological evidence from Vaux-Malaucène and the analytical results from Châteauneuf-du-Pape confirm that Rhone Valley flint sources were already being exploited in the Middle Neolithic in Southern France. On the other hand, the lack of waisted hammerstones on Chasséen sites would suggest that techniques and scale of exploitation altered from the Chasseen to the Chalcolithic.

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