ARCHAEOMAGNETIC REPORT FOR THE PAYSON ARCHAEOLOGICAL RESEARCH EXPEDITION

by

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INTRODUCTION

Archaeomagnetic results from nine samples recovered from five sites located northeast of Phoenix, Arizona are presented in this report. The sites were excavated as a part of the Arizona State University's (ASU) archaeological field school under the direction of John W. Hohman. ASU has contracted with the Colorado State University (CSU) Archaeometric Laboratory for archaeomagnetic analysis of the samples. The samples were collected by Jerry Howard and Mark Lane for ASU during the summer of 1985.

Five samples were recovered from Shoofly Village (AZ:D:11:6 (ASU)), a multi-component site. The features sampled were believed to date from AD 1150 to AD 1250. Two samples (#4 and 5) were recovered from the same structure, but at different living surfaces. The archaeomagnetic results from these samples were generally poor. Only one sample had demagnetized results with alpha 95 values under 3.5^{o}, and this sample did not occur near known locations of the Southwest VGP Curve. One other sample plotted also did not occur near the curve, and both samples are suspected to have been recovered from slumped matrices. Two samples were provided with archaeomagnetic age estimates and one sample was not provided with either a paleopole plot or a date due to an overlarge alpha 95 value.

Four samples were recovered from four sites in the Tonto National Forest; AR:03:12:04:52-1, AR:03:12:04:138-1, AR:03:12:04:491-1 and AR:03:12:04:532-1. The archaeomagnetic

results from these samples were much better. Only one sample had demagnetized results with an alpha 95 value of over 3.5°. All samples were plotted, one of which did not occur on the Southwest VGP Curve, but which is believed to date to just prior to AD 700 (the earliest extention of the curve) or to proto-historic or historic times.

LABORATORY OPERATIONS

The analysis provided by the CSU Archaeometric Laboratory includes measurement of a samples' magnetic remanence in the pristine condition (referred to as Natural Remanent Magnetization - NRM) and a series of `demagnetization' steps. A Schonstedt spinner magnetometer is employed for specimen measurement and an alternating current (AC) demagnetizer is used for the demagnetization procedures. The processing of each sample is unique because of the individual qualities of each sample, but it follows general guidelines established by laboratory personnel from previous tests and experiments (Hathaway 1982, Krause 1980).

Because each feature or sample may be subjected to exterior magnetic interferences which may overprint, disrupt or alter the magnetic orientation acquired at the time of firing, the samples are `demagnetized' in an attempt to remove the unwanted `secondary' components acquired after firing (or collection). Generally, magnetic components acquired after a material has been heated are spurious and less stable than the primary magnetism acquired at firing. These secondary components may, therefore, be randomized

(e.g., removed) by relatively low levels of AC demagnetization while the primary magnetism remains strong. However, occasionally, samples are subjected to very strong secondary influences which may require higher levels of demagnetization.

Demagnetization is performed in `steps' at varying levels of maximum AC fields measured in oersteds. Each step is dependent upon the results from the previous step(s); so that, weaker samples are not subjected to overlarge fields which might destroy the primary magnetism as well as the unwanted secondary components. Demagnetization is continued until the sample magnetic direction remains stable and/or the alpha 95 values increase greatly. The optimum demagnetization level is then determined based on directional stablity and sample directional cohesion (the alpha 95 value is one of the indicators of cohesion). Generally, archaeomagnetic samples can be `cleaned' of secondary components by 100 oersteds of AC demagnetization.

Occasionally, it is necessary during analysis to delete a specimen from the sample results. Such a specimen is referred to as an outlier. Outliers are defined by specimen directions which, for some reason, deviate from the sample cluster and mean direction such that it is no longer considered to be representative of the sample. Outliers are removed from the sample, and the sample results recalculated. Because outliers may effect the mean sample direction and statistical measures disportionately, their exclusion improves the estimate of the true paleodirection.

Until recently, only demagnetized samples which had alpha 95 values equal to or less than 3.5° were considered for archaeomagnetic dating purposes. This criteria was initiated in 1980 by laboratory personnel as a cutoff point at which the dating range provided was useful for cultural dating of a site. The cutoff point for dating did not represent a lack of confidence in the paleopolar direction of samples with alpha 95 values over 3.5°. Rather, the direction of samples with large confidence intervals could not be precicely defined due to the large areas described by the ovals of confidence. However, since it is often important to archaeologists to provide relative dating sequences for structures on a single site or even to provide very large-range dates based on the archaeomagnetic information, the CSU laboratory has been providing paleopole plots of all demagnetized results with our recommendations as to reliability and stability. There are, however, still practical restaints of over-large alpha 95 values. Values over 10.0° have such large ovals of confidence that the entire curve will be encompassed, thereby not excluding any temporal possibilities.

Development of the Southwest VGP Curve

Dating archaeomagnetic samples requires the development of a regional virtual geomagnetic pole (VGP) curve calibrated to precise chronometric ages by independently dated archaeomagnetic pole positions. Generally, samples independently dated by tree ring or radio carbon to within a 100 year range are used for building a regional VGP curve. As the data set of independently dated samples

increases, the precision of the VGP curves improve, and polar movement in previously unknown time periods are documented and calibrated. Therefore, regional curves are continually being revised to provide the archaeological community with the most current information available.

Several VGP curves have been constructed for the American Southwest in the past. Dr. R.L. DuBois provided the first curve available for the Southwest (DuBois 1975, Watanabe and DuBois 1965 and Wolfman 1979). This curve was reportedly constructed from over 500 independently dated samples collected from the southwest region. However, since the actual data has not been published or made public, this information is of little use to other archaeomagnetists working in the Southwest. Therefore, several archaeologists and geophysicists concerned with the problem began to collect their own data sets of archaeomagnetic samples from the Southwest which could be independently dated by tree ring or carbon 14. Researchers from Colorado State University and the University of Arizona have recently published lists of archaeomagnetic sample results with the associated independent dating available (Eighmy, Hathaway and Kane 1985, McGuire and Sternberg 1982, and Sternberg 1982). These data sets are now available for use by any interested individual.

Development of a VGP curve from the available data sets has been accomplished in two major ways. The method used in the past, and occasionally still used, relies upon the compilation of two sets of curves - the average values from sample declinations and

inclinations - which were then combined with the site latitude and longitude to provide the north polar curve or VGP curve. Recently, however, Dr. R.S. Sternberg has developed a statistical method of calculating VGP curves from the sample VGP locations. The method utilizes a range of time, referred to as a 'window', which is employed to average all the VGP sample locations dating within a given window. The length of the window is determined from the range of independent dates provided in the data set and is approximately equal to the average independent time range. Windows along an entire curve will be constructed of different time lengths based on the data available. The windows are increased along the time scale to the limits of the independent dating of the archaeomagnetic samples. The increments are generally one-half the length of the windows used. It is possible to have 'gaps' in the curves where less than 2 samples date to a given window of time.

The criteria used to select the independently dated samples for curve-building may vary from one laboratory to another, and, so, it is important to be aware of the information used in developing a particular curve and the limitations of the curve used. Different sets of data will result in differences in the curve location and precision with which the location is known. The CSU Archaeomagnetic Laboratory criteria for samples used in curve-building is fairly strict and, therefore, not all samples with independent dating published will be used for development of a curve. The criteria includes any sample with demagnetized results of 3.5^{o} alpha 95 values or less and for which the independent dating is within a 100 year range. The sample data used in the CSU

Archaeomagnetic Laboratory's version of the Southwest VGP Curve is presented in Table 1. The subsequent curve developed from this information is presented in Table 2 and visually in Figure 1. The mean dates of the windows are provided in Figure 1 (e.g., the 700 date represents the 680-720 window); dates along the curve from AD 700 - AD 900 represent 20 year windows and dates along the curve from AD 900 - AD 1375 represent 50 year windows.

Dating archaeomagnetic samples

Dating an archaeomagnetic sample ultimately relies upon the samples' juxtaposition to the regional VGP curve. The dating method may be conducted in one of two ways; visual or statistical. The statistical method is used in this report as developed by Dr. R.L. Sternberg (Sternberg 1982). This technique depends first upon the development of a statistically-created curve (as described above). Each window location along the curve (e.g., AD 680-720 through AD 1375-1425) is then compared to the VGP location of the undated sample. The precise probability that the sample location is the same as a given window is calculated for all cases. The archaeomagnetic date is then determined based on the probabilities at the various windows. All date windows associated with a probablility of .95 or less are deamed as possible 'dates' for the archaeomagnetic sample being tested (e.g., this is the 95% confidence level). The smallest date range possible for any sample is dependent upon the window range selected for the curve-building and ultimately on the range of the independent dates of samples

Table 1. Archaeomagnetic samples used in calibrating the current Southwest Master Curve.

LAB DESIG.	ALPHA 95	PLAT	PLONG	INDEP. DATING RANGE
DAPP 1	2.21	82.30	244.94	AD 620 - 680
DAPP 2	1.92	81.85	180.06	AD 620 - 680
DAPP 4	1.93	86.27	356.49	AD 670 - 730
DAPP 71	3.20	88.69	70.16	AD 674 - 700
DAPP 3	1.96	82.84	36.20	AD 675 - 705
DAPP 5	1.72	87.73	44.62	AD 695 - 755
DAPP 6	2.03	82.94	52.13	AD 720 - 780
DAPP 7	2.38	83.43	54.62	AD 720 - 780
DAPP 99	1.52	81.29	63.12	AD 725 - 825
DAPP 114	2.04	80.26	60.39	AD 725 - 825
DAPP 8	2.20	79.98	61.88	AD 730 - 790
DAPP 91	2.99	86.54	68.72	AD 750 - 850
DAPP 96	3.46	84.03	15.90	AD 760 - 785
DAPP 9	2.15	86.12	77.67	AD 760 - 800
DAPP 145	1.53	82.78	60.09	AD 760 - 800
DAPP 112	2.07	84.04	47.78	AD 760 - 825
DAPP 113	2.49	82.88	45.55	AD 760 - 825
DAPP 10	2.25	87.29	8.97	AD 770 - 790
DAPP 11	1.88	81.00	65.29	AD 780 - 800
DAPP 12	1.32	78.98	42.30	AD 780 - 800
DAPP 13	2.55	78.48	58.25	AD 780 - 800
DAPP 64	2.00	84.99	65.72	AD 785 - 820
DAPP 15	1.28	78.05	45.05	AD 790 - 810
DAPP 16	1.40	76.53	53.45	AD 800 - 840
DAPP 17	1.65	75.28	57.24	AD 800 - 840
DAPP 115	2.12	81.53	51.03	AD 800 - 860
DAPP 100	1.30	79.43	52.19	AD 800 - 900
DAPP 147	1.28	80.74	63.50	AD 800 - 900
DAPP 44	2.10	81.40	68.17	AD 805 - 815
DAPP 116	2.53	85.21	38.94	AD 825 - 910
DAPP 127	2.02	82.31	68.08	AD 835 - 855
DAPP 18	2.19	84.43	37.83	AD 845 - 875
DAPP 102	2.77	81.05	49.04	AD 850 - 870
DAPP 129	2.77	83.51	35.24	AD 850 - 870
DAPP 139	2.23	82.52	16.12	AD 850 - 870
DAPP 146	1.81	79.72	21.21	AD 850 - 870
DAPP 94	2.47	86.56	5.44	AD 850 - 910
DAPP 111	2.59	84.72	105.18	AD 850 - 910
DAPP 117	3.48	81.47	13.91	AD 850 - 910
DAPP 19	1.82	88.14	301.40	AD 855 - 875
DAPP 28	2.28	86.20	0.53	AD 855 - 910

Table 1. Archaeomagnetic samples used in calibrating the current Southwest Master Curve. (continued)

LAB DESIG.	ALPHA 95	PLAT	PLONG	INDEP.	DATING RANGE
DAPP 20	2.21	87.52	4.29	AD	860 - 880
DAPP 142	1.74	84.45	17.53	AD	860 - 890
DAPP 106	1.28	85.36	54.99	AD	860 - 890
DAPP 27	2.54	85.21	28.16	AD	860 - 890
DAPP 21	2.34	88.19	344.94	AD	860 - 900
DAPP 22	1.48	89.32	330.14	AD	860 - 900
DAPP 126	1.87	86.66	337.49	AD	860 - 910
DAPP 105	3.14	84.65	351.32	AD	860 - 910
DAPP 118	2.77	80.91	41.45	AD	860 - 910
DAPP 133	2.09	84.21	57.63	AD	860 - 925
DAPP 136	1.21	83.46	38.52	AD	862 - 892
DAPP 134	3.54	78.07	7.50	AD	865 - 885
DAPP 144	2.81	81.23	43.69	AD	865 - 885
DAPP 26	1.71	84.01	30.35	AD	865 - 895
DAPP 85	2.23	86.69	14.30	AD	865 - 915
DAPP 24	1.39	82.48	53.56	AD	870 - 890
DAPP 25	1.44	87.20	319.19	AD	870 - 890
DAPP 131	3.02	82.57	31.37	AD	870 - 890
DAPP 90	3.53	87.54	9.74	AD	870 - 900
DAPP 124	2.69	86.51	19.37	AD	870 - 900
DAPP 29	3.01	85.12	7.92	AD	870 - 910
DAPP 121	2.19	89.09	97.65	AD	870 - 910
DAPP 122	2.37	82.10	12.52	AD	870 - 910
DAPP 123	2.23	83.20	12.76	AD	870 - 910
DAPP 92	3.03	79.27	12.93	AD	870 - 910
DAPP 125	2.98	89.36	215.86	AD	870 - 910
DAPP 137	2.70	84.31	2.70	AD	875 - 910
DAPP 103	1.49	86.03	352.07	AD	875 - 910
DAPP 104	2.30	84.73	38.14	AD	875 - 910
DAPP 30	2.33	86.32	9.94	AD	880 - 900
DAPP 31	1.12	86.27	32.18	AD	880 - 900
DAPP 32	1.73	78.23	27.42	AD	880 - 900
DAPP 33	1.43	81.42	33.99	AD	880 - 900
DAPP 34	1.72	82.79	20.74	AD	880 - 900
DAPP 132	1.94	83.95	35.67	AD	880 - 900
DAPP 138	1.59	81.48	21.50	AD	880 - 900
DAPP 140	1.71	79.85	32.24	AD	880 - 900
DAPP 143	2.05	82.51	32.05	AD	880 - 900
DAPP 101	3.01	85.52	26.59	AD	880 - 900
DAPP 128	3.04	85.42	19.49	AD	880 - 900
DAPP 130	2.89	82.37	47.37	AD	880 - 900
DAPP 89	3.18	79.32	352.93	AD	880 - 900
DAPP 23	1.00	85.05	27.66	AD	880 - 900

Table 1. Archaeomagnetic samples used in calibrating the current Southwest Master Curve. (continued)

LAB DESIG.	ALPHA 95	PLAT	PLONG	INDEP. DATING RANGE
DAPP 35	2.34	83.80	195.20	AD 880 - 920
DAPP 88	1.73	85.89	311.11	AD 880 - 920
DAPP 135	2.57	80.99	40.46	AD 890 - 910
DAPP 141	1.42	82.45	27.23	AD 890 - 910
DAPP 84	3.25	88.86	191.39	AD 890 - 920
DAPP 36	1.50	86.40	131.97	AD 890 - 920
DAPP 66	1.80	87.62	149.18	AD 936 - 1000
DAPP 67	2.00	83.16	239.45	AD 936 - 1000
DAPP 148	1.33	76.46	201.93	AD 1045 - 1055
DAPP 86	2.90	75.54	193.50	AD 1000 - 1100
DAPP 68	3.30	76.11	207.15	AD 1020 - 1050
DAPP 87	2.00	73.59	176.59	AD 1050 - 1150
DAPP 65	3.10	63.18	209.75	AD 1060 - 1150
DAPP 82	2.80	72.76	192.53	AD 1088 - 1097
DAPP 53	1.70	77.32	196.57	AD 1100 - 1200
DAPP 83	2.90	76.63	194.84	AD 1101 - 1130
DAPP 72	2.10	73.14	189.77	AD 1107 - 1150
DAPP 119	1.90	75.93	197.12	AD 1130 - 1170
DAPP 73	1.40	78.35	185.11	AD 1150 - 1250
DAPP 74	3.30	78.50	186.04	AD 1150 - 1250
DAPP 75	1.50	77.14	194.34	AD 1150 - 1250
DAPP 76	2.60	76.41	195.16	AD 1150 - 1250
DAPP 63	1.20	76.72	190.77	AD 1150 - 1250
DAPP 77	1.90	82.35	218.91	AD 1175 - 1275
DAPP 78	3.50	79.34	166.02	AD 1175 - 1275
DAPP 79	1.40	84.37	209.39	AD 1175 - 1275
DAPP 80	1.50	82.23	209.39	AD 1200 - 1300
DAPP 81	2.00	81.47	185.04	AD 1200 - 1300
DAPP 120	1.70	82.39	193.86	AD 1220 - 1280
DAPP 50	2.00	67.89	225.16	AD 1240 - 1300
DAPP 51	2.10	72.68	198.18	AD 1240 - 1300
DAPP 52	3.20	75.74	196.57	AD 1240 - 1300
DAPP 49	3.20	86.62	216.26	AD 1250 - 1272
DAPP 61	1.90	86.61	162.90	AD 1270 - 1300
DAPP 46	2.30	81.21	199.75	AD 1271 - 1300
DAPP 70	2.10	78.44	212.66	AD 1272 - 1300
DAPP 56	3.20	84.72	204.73	AD 1275 - 1325
DAPP 69	3.00	79.87	221.60	AD 1280 - 1300
DAPP 47	2.30	81.59	209.55	AD 1285 - 1300
DAPP 48	3.30	79.81	188.36	AD 1285 - 1300

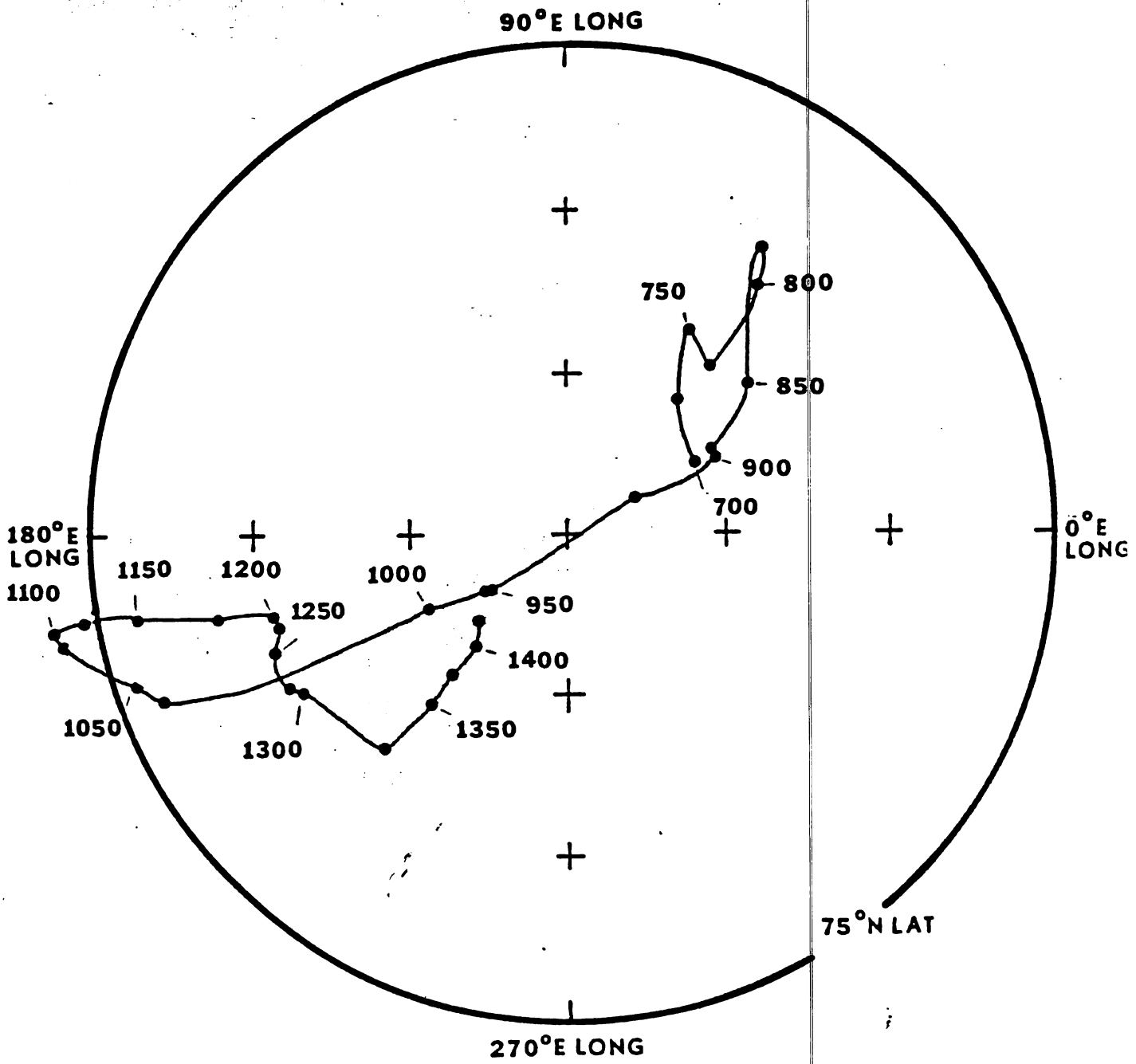
Table 1. Archaeomagnetic samples used in calibrating the current Southwest Master Curve. (continued)

LAB DESIG.	ALPHA 95	PLAT	PLONG	INDEP. DATING RANGE
DAPP 62	3.20	80.52	211.55	AD 1300 - 1325
DAPP 58	2.50	78.05	225.38	AD 1300 - 1350
DAPP 57	2.30	82.53	256.55	AD 1300 - 1375
DAPP 55	2.10	84.17	208.42	AD 1350 - 1375
DAPP 59	2.90	83.50	238.45	AD 1350 - 1400
DAPP 60	2.60	83.06	233.73	AD 1350 - 1400
DAPP 54	1.30	85.43	228.19	AD 1385 - 1450
DAPP 97	1.93	86.86	224.65	AD 1400 - 1425
DAPP 93	2.60	76.50	299.20	AD 1850 - 1875

Table 2. VGP locations and precisions for windows of time along the current Southwest Master Curve.

WINDOW OF TIME BEGIN	END	ALPHA 95	PLAT	PLONG	NUMBER OF SAMPLES
690	710	3.53	85.98	29.61	4
715	735	2.68	84.71	49.94	7
740	760	2.19	82.80	58.53	7
765	785	1.53	83.31	47.74	16
790	810	1.39	80.38	52.52	18
815	835	1.92	79.33	55.68	12
840	860	1.88	82.72	39.32	16
865	885	0.88	85.03	28.67	57
890	910	1.00	84.90	27.65	48
900	950	1.71	87.34	27.98	27
925	975	15.69	86.79	214.22	2
950	1000	15.69	86.79	214.22	2
975	1025	6.93	85.06	207.19	4
1000	1050	2.03	76.26	202.20	3
1025	1075	3.53	75.79	198.54	5
1050	1100	4.88	73.98	192.81	5
1075	1125	3.71	73.70	191.24	7
1100	1150	3.98	74.47	191.83	6
1125	1175	1.91	76.10	192.00	11
1150	1200	2.01	78.76	193.24	10
1175	1225	2.03	80.23	194.63	12
1200	1250	2.24	80.16	196.99	14
1225	1275	2.63	80.07	203.32	18
1250	1300	2.90	80.10	207.95	17
1275	1325	2.76	80.28	209.64	16
1300	1350	4.74	81.18	228.09	4
1325	1375	3.11	83.06	229.91	5
1350	1400	1.90	84.13	229.23	5
1375	1425	1.64	85.40	229.68	4
1400	1450	2.84	85.83	227.44	2

Figure 1. The current Southwest VGP Curve.



used in construction of the curve. Although this method is accomplished through computer analysis using the demagnetized results of the samples, a visual plot of the archaeomagnetic sample with the appropriate curve is provided with the laboratory report. In addition, the mean VGP location of each of the samples is plotted with the appropriate curve for analysis of the relative order of samples from associated features or sites.

ARCHAEOMAGNETIC RESULTS

The archaeomagnetic results from the nine samples recovered on Shoofly Village and sites in the Tonto National Forest were generally poor. Four of the samples could not be dated, either due to paleopole locations not occurring near the Southwest Curve or poor archaeomagnetic results. Five samples were dated, based on their relative paleopole positions to the current Southwest VGP Curve.

The magnetic declinations of the five sites, as determined from the USGS map 'Magnetic declination in the United States - Epoch 1980.0' for the 1985 field season, is 12.5° East of True North. The site locations are as follows:

SITE	LATITUDE	LONGITUDE
	°	°
AZ:D:11:6	34.29 N	248.72 E
AR:03:12:04: 52	34.23° N	248.69° E
AR:03:12:04:138	34.24° N	248.71° E
AR:03:12:04:491	34.27° N	248.68° E
AR:03:12:04:532	34.24° N	248.66° E

The archaeological information for the nine samples is presented in Table 3. All but one of the matrices collected were from fire-hearth features. One sample was collected from a burned wall feature. There is a problem associated with the collection of earthen walls which was discovered on the Dolores Project in the early 1980's. Often times, a wall or other vertical collecting surface can slump as a unit, causing the direction of the thermoremanence to be systematically offset. Although in the field slumpage of more than 10^{o} is perceptible, less movement can still cause the archaeomagnetic direction to dislocate such that the sample paleopole location does not occur near the VGP curve. Furthermore, if the sample still is located near the curve, the resulting date estimate will not be representative of the true date of the feature useage. The CSU lab has devised a method for at least recognizing this problem in the laboratory. Whenever possible, wall features recovered are collected from two different facing walls such that the slumpage would be in a different direction. If 6-8 specimens per wall surface are recovered, then the mean paleopole location of these two groups can be compared for differences. If no difference in the locations exist, then the wall(s) can be assummed to be <u>in situ</u> and the archaeomagnetic date resulting is a true estimate of the conflagration of the structure. Unfortunately, only one face of the structure was collected for Sample AZ:D:11:6 - 2, thus the lab cannot provide any evaluation of the probability of slumpage. However, field notes from the sample indicate that slumpage is a possibility.

Table 3. The archaeological information for archaeomagnetic samples recovered from sites excavated during the 1985 Arizona State University's field school.

SAMPLE	PROVENIENCE & FEATURE NO.	FEATURE TYPE	ARCHAEOLOGICAL TEMPORAL EST.
	SITE AR:03:12:04:52		
1	Room 3	Hearth	1150 - 1250
	SITE AR:03:12:04:138		
1	Room 1	Hearth	1150 - 1250
	SITE AR:03:12:04:491		
1	Pitstr. 1	Hearth	1000 - 1150
	SITE AR:03:12:04:532		
1	Room 5	Hearth	1200 - 1300
	SITE AZ:D:11:6		
1	S. Plaza E87 N81	Hearth	1150 - 1250
2	E113 N124	Wall	1150 - 1250
3	E113 N124	Hearth	1150 - 1250
4	E123 N158	Later Hearth	1150 - 1250
5	R123 N158	Earlier Hearth	1150 - 1250

The archaeological age estimates provided in the field for the samples ranged from AD 1000-1150 to AD 1200-1300. The age estimates on Shoofly Village all were believed to date between AD 1150 and AD 1250. Sites AR:03:12:04:52 and AR:03:12:04:138 were thought to be contemporateous with the Shoofly Village, site AR:03:12:04:491 was probably occupied prior to these sites and site AR:03:12:04:532 was probably the latest site tested.

The final (demagnetized) archaeomagnetic results from the nine samples are presented in Table 4. Sample AZ:D:11:6 - 3 was recognized as very poor at NRM, and, hence, was not demagnetized. The other samples had demagnetized results with alpha 95 values ranging from 2° to 8°. The statistically derived dates based on these results are provided in Table 5. These dates represent the 95% confidence level and are based on the most recent version of the Southwest Curve established by the CSU lab in March, 1986. Although these dates are comparable to the visual dates provided in the original laboratory reports, they are slightly more conservative (e.g., wider age ranges). Three samples could not be dated by either visual or statistical method. Sample AR:03:12:04:52 - 1, however, is within a feasible range evaluated by the lab as either pre AD 700 or post AD 1450. This evaluation is based on an early curve reported, but undocumented, by DuBois (Figure 2) and the combination of the known modern curve, known protohistoric VGP locations and later curve extensions provided by DuBois (Figure 3). In either case, the estimate is prior to or later than the archaeological age provided in the field. Samples AZ:D:11:6 - 2 and 4 both are located fairly far from any known

Table 4. The final archaeomagnetic results for samples recovered from sites excavated during the 1985 the Arizona State University field school.

SAMPLE	N1/N2*	DEMAG	ALPHA 95	INTENSITY	DECL	INCL	PLAT	PLONG	EP	EM
					SITE AR:03:12:04:52					
1	12/12	100	2.78	0.052 E-7	9.87	54.48	81.85	330.52	2.76	3.92
					SITE AR:03:12:04:138					
1	12/11	150	3.48	1.167 E-7	353.32	58.99	82.33	206.63	3.87	5.19
					SITE AR:03:12:04:491					
1	12/12	100	3.90	2.898 E-7	5.54	52.44	85.23	352.21	3.69	5.37
					SITE AR:03:12:04:532					
1	12/12	125	3.21	0.432 E-7	6.65	52.74	84.40	346.26	3.05	4.43
					SITE AZ:D:11:6					
1	12/12	100	7.98	0.766 E-7	0.53	54.18	89.39	294.41	7.87	11.20
2	12/12	100	2.29	2.199 E-7	18.89	65.38	70.64	290.02	3.02	3.72
3	12/12	NRM	13.07	0.080 E-7	305.27	72.70	46.93	209.52	20.66	23.24
4	12/12	100	5.44	0.820 E-7	346.19	69.93	68.17	226.46	8.04	9.36
5	12/11	100	5.64	0.070 E-7	357.46	54.95	87.60	189.19	5.67	7.99

* N1 represents the number of specimens collected from the feature, N2 represents the number of specimens used for the final analysis (e.g., removing any outliers).

Note: Demagnetization level is in units of Oersteds; alpha 95, inclination, EP and EM is in units of degrees; declination and paleolongitude are in units of degrees East; paleolatitude is in units of degrees North; and intensity is in units of Tesla.

Table 5. Statistical dating at the 95% confidence level for samples from the Arizona State University's field school.

SITE	SAMPLE	95% CONFIDENCE DATING
AR:03:12:04: 52	1	None possible
AR:03:12:04:138	1	AD 925-1025; AD 1150-1450
AR:03:12:04:491	1	AD 680- 735; AD 845-1000
AR:03:12:04:532	1	AD 680- 725; AD 925-1000
AZ:D:11:6	1	AD 680- 800; AD 835-1025; AD 1300-1450
AZ:D:11:6	2	None possible
AZ:D:11:6	4	None possible
AZ:D:11:6	5	AD 680- 800; AD 900-1025; AD 1300-1450

Figure 2. Representation of the DuBois Southwest Curve, AD 600 - 800.

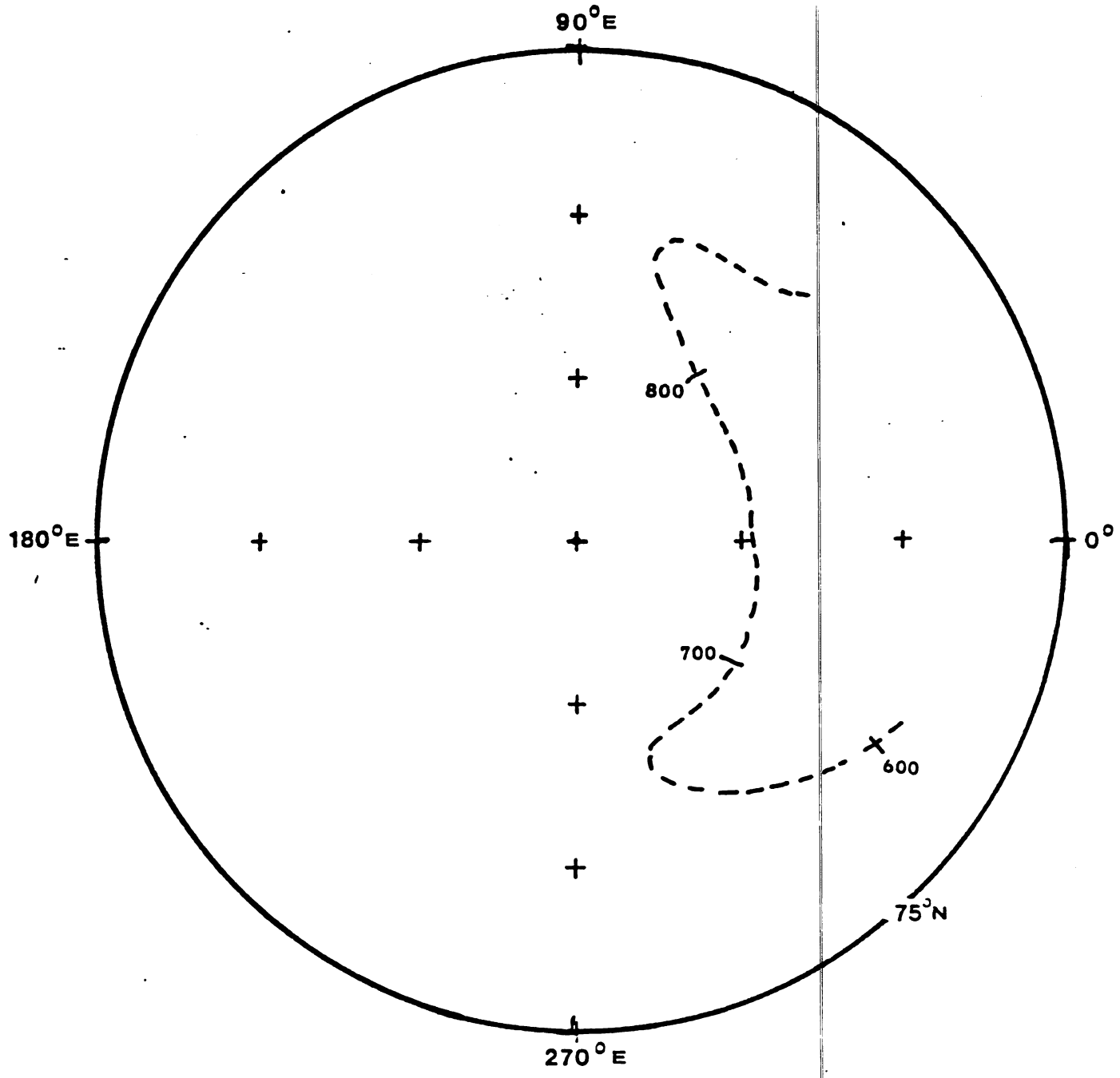
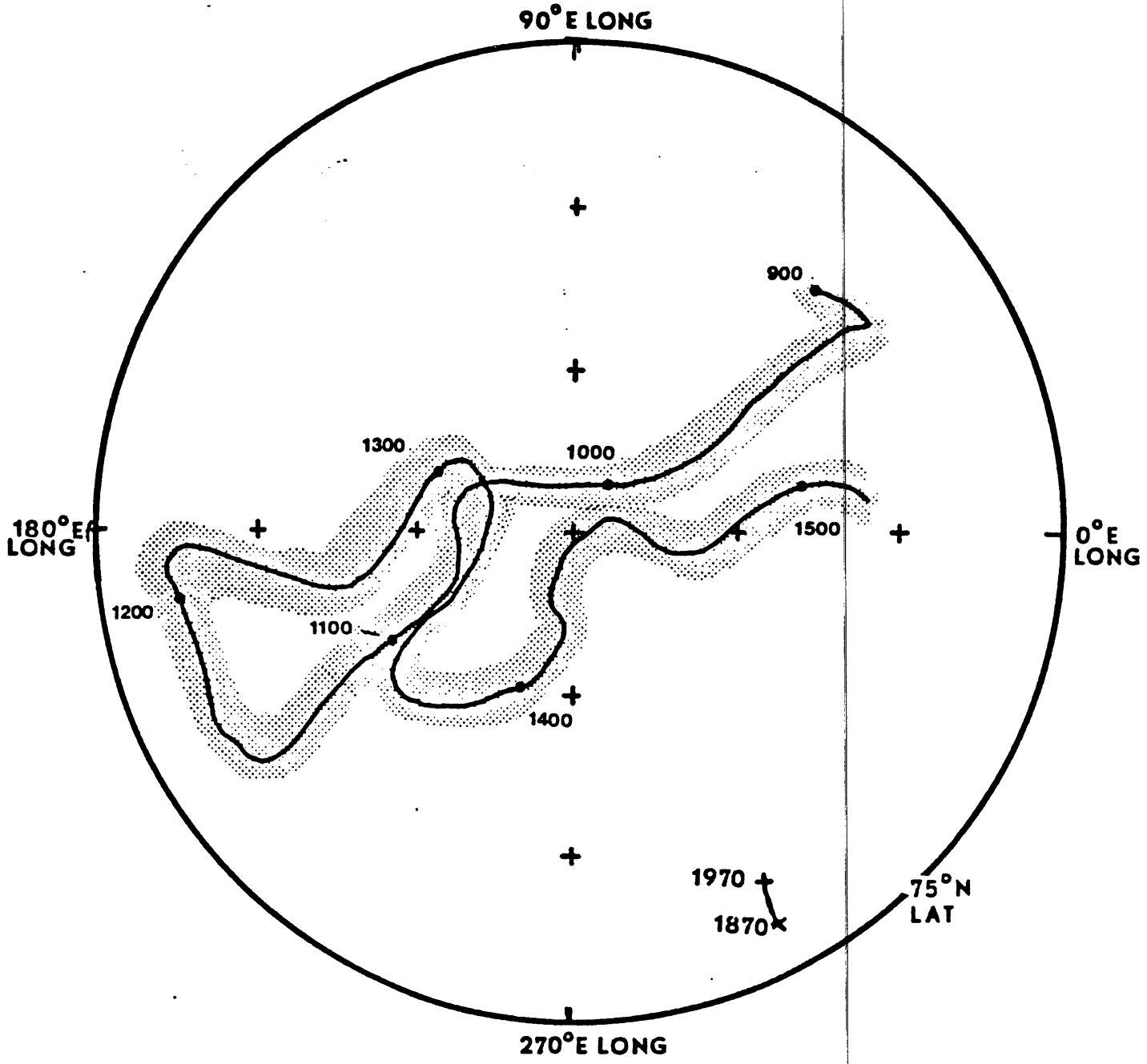


Figure 3. Representation of the DuBois Southwest Curve with the modern curve.



extensions of the Southwest VGP Curve. As Sample 2 was recovered from a wall matrix and Sample 4 was recovered from a hearth situated in the fill of a structure, both are suspected of slumpage. No dates for these samples are possible. The two samples from site AZ:D:11:6 which did provide good dates (# 1 and 5) are archaeomagnetically dated to time periods either just prior to or later than the archaeological estimates. Archaeomagnetic date alternatives from AR:03:12:04:532 - 1 are earlier than the dates suggested by the archaeological evidence, however, the sample is located in an area very possibly associated with the later extensions of the Southwest Curve (see Figure 3). The samples from sites AR:03:12:04:138 and AR:03:12:04:491 are both compatible with the archaeological estimates.

The mean paleopole plots of the samples are provided in Figures 4 and 5. Samples AZ:D:11:6 - 1 and 5 are very close to one another and probably represent contemporaneous useages. Please note the very distant locations of both Samples 2 and 4 from these samples. The relative positions of the samples from sites AR:03:12:04:491 and AR:03:12:04:532 are very near to one another and could represent contemporaneous sites. The sample from site AR:03:12:04:138 is located away from these two samples and either represents an earlier or later site than sites AR:03:12:04:491 or AR:03:12:04:532, depending upon the respective archaeomagnetic alternatives accepted.

Figure 4. The mean paleopole plots of samples from Shoofly Village with the current Southwest VGP Curve. Designation is by sample number only.

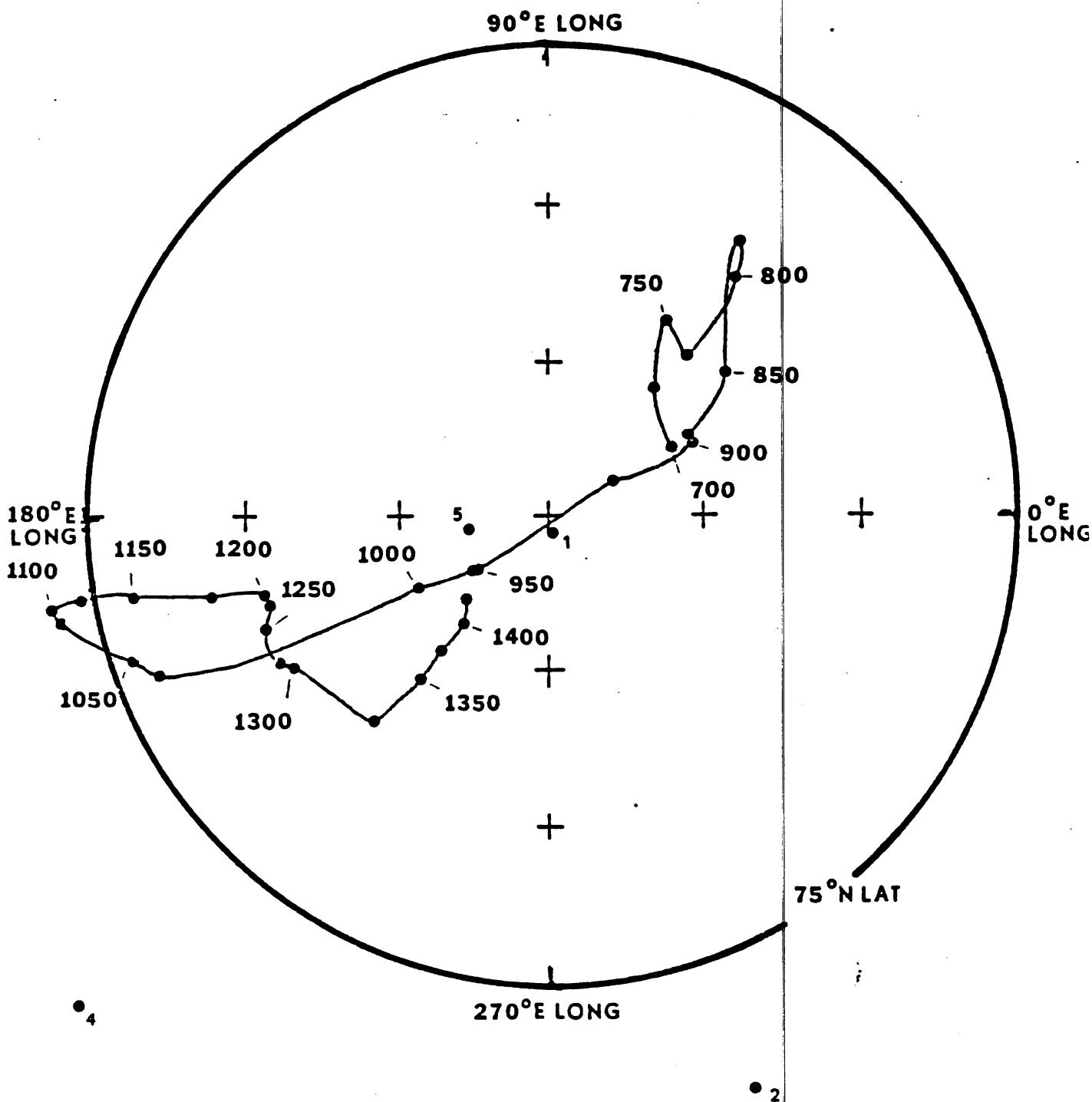
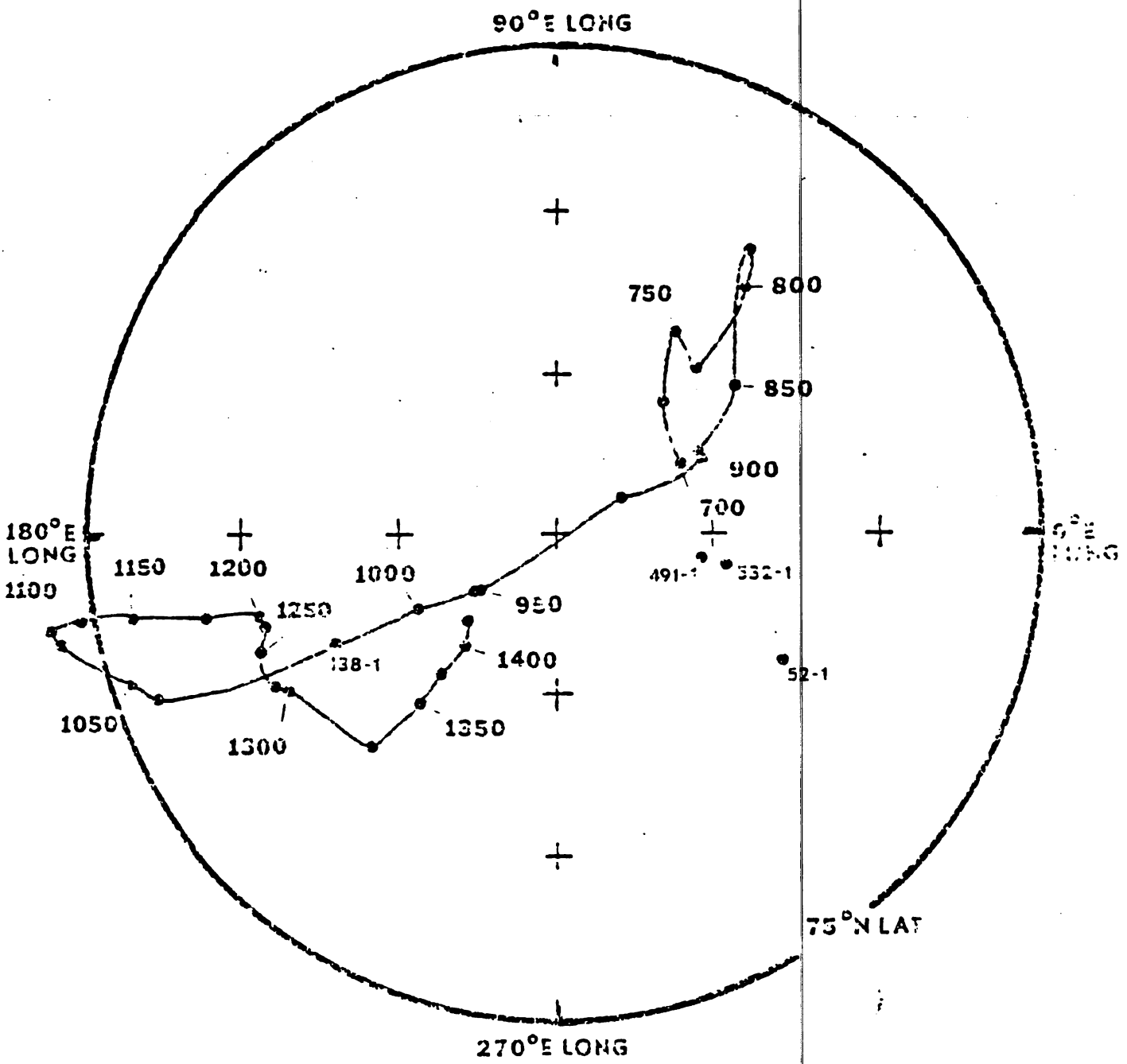


Figure 5. Mean paleopole plots of samples from the Tonto National forest sites with the current Southwest VGP Curve. Designation is by the last portion of the site number with the sample number trailing.



SUMMARY

Five of the nine samples submitted to the CSU Archaeometric laboratory from the ASU field school provided chronometric dates for the associated features on these sites. The archaeomagnetic dates on sites AZ:D:11:6 and AR:03:12:04:52 present some problems when compared with the archaeological age evaluations. The other dates, however, are compatible with the archaeological estimates. The samples were generally of poor quality, although the remanent intensity levels were of magnitudes normally associated with well fired material which can produce quite good results.

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