Chapter 1 Introduction

1.1 Geomagnetism and archaeomagnetism

The Chinese discovered magnetism more than 2000 years ago (Needham, 1962). From about A.D. 83, Chinese observers noticed the directional characters of the Earth's magnetic field. This may be considered as the beginning of geomagnetism (Malin, 1987). In 1269, Petrus Peregrinus reported his famous experimental results with spherical pieces of lodestone (naturally occurring iron oxide). He defined the concept of polarity, discovered magnetic meridians and used several methods to determine the positions of poles of a lodestone sphere.

In 1600 William Gilbert published his notable scientific treatise *De Magnete* which strongly influenced the course of magnetic study. In this book he presented the results of many years of his study of magnetism. He stated that "the Earth itself is a great magnet". Gilbert's work indicated that the geomagnetic field is mainly dipolar.

The geomagnetic field at any location is a vector quantity, having both magnitude and direction. It is convenient to determine the geomagnetic field by three of the quantities illustrated in Figure 1.1. Inclination, I, is the angle between the horizontal plane and the magnetic vector. The inclination is reckoned positive when the magnetic vector points downward and negative when it points upward. Declination, D, is the angle between geographical north and the horizontal component of the magnetic field vector. D is always measured clockwise from the present geographic north. F is the total intensity of the Earth's magnetic field. Sometimes it is convenient to resolve F to geographical directions; the north component X; the east component Y; the horizontal component H; and the vertical downward component Z.

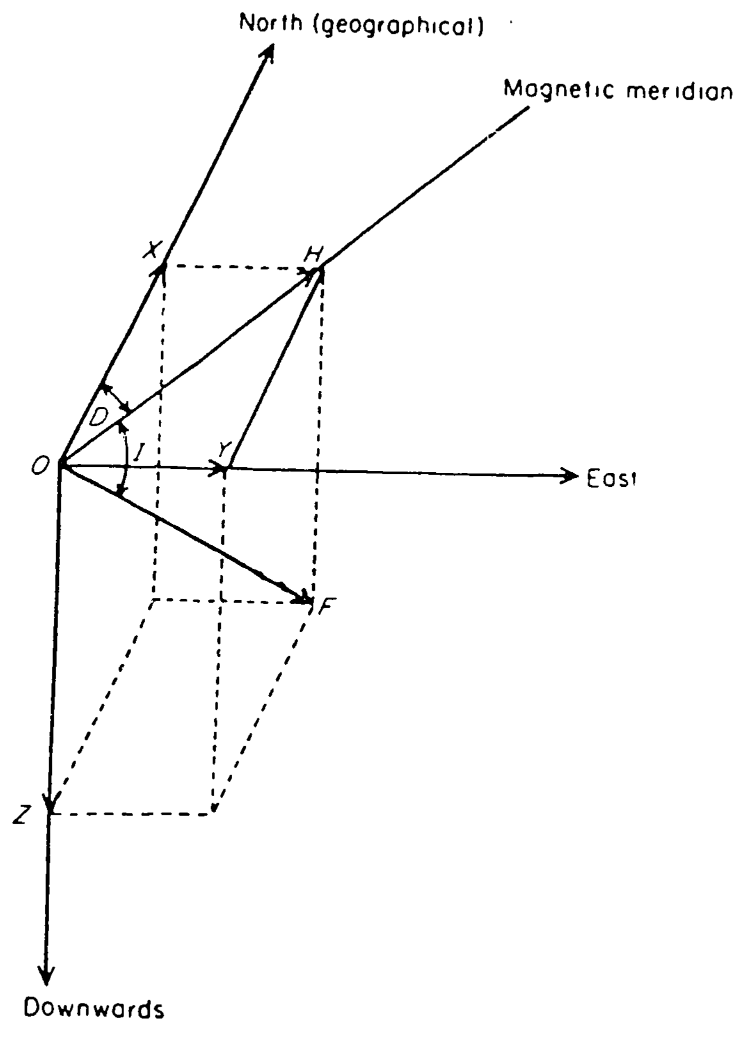

Figure 1.1. *The main elements of geomagnetic field*

It is now known that the magnetic field at any given location near the Earth's surface can be ascribed to three sources located (1) in the Earth's core, (2) in the Earth's crust, and (3) in the Earth's ionosphere and beyond. The magnetic field from the core is called the main field, and it is the largest in magnitude. The strength of the main field varies from approximately 30μT at the equator to 60μT at the poles. In 1837, C.F. Gauss was the first person to study the geomagnetic field by using spherical analysis. The present best fitting dipole is situated at the Earth's centre and its axis makes an angle of 11.5° with the rotation axis. When the dipole field is subtracted from the observed value, the residual is called the non-dipole field. The non-dipole field comprises only about 1/20 of the total field.

In 1634, Henry Gellibrand discovered that declination changes with time. It was later discovered that both inclination and intensity also vary with time. These changes in magnetic field are now called secular variation. Direct observation of the direction of the geomagnetic field began about 400 years ago, but it was more than 200 years later before the strength of the geomagnetic field was successfully measured. Since the geomagnetic field changes in a very complicated way, it is not enough for us to study the geomagnetic field by using only the data from direct instrumental observations. With the development of archaeomagnetism, it is now possible to learn more about the long-term history of the geomagnetic field.

One very important feature of magnetism is that it is the only geophysical property that can be measured and determined throughout time. Archaeomagnetic techniques make use of the phenomenon that certain minerals are capable of retaining a record of the past direction and intensity of the geomagnetic field, and therefore the direction and strength of the geomagnetic field can be studied over archaeological time scales (Thellier, 1981; Walton, 1990).

1. 2 Principles of rock magnetism

Rock magnetism is the term applied to the study of the magnetic properties of rocks and minerals, and the origin and characteristics of the different types of remanent magnetisation which rocks and minerals can acquire.

The best way to introduce the different types of magnetism is to describe how materials respond to a magnetic field. In diamagnetic substances the electron shells are full and the precession of electron orbits creates a magnetic field in the opposite direction to the applied field. Because the induced magnetisation is in the opposite direction to the applied field, the susceptibility (the magnetisation acquired per unit field applied) is negative and typically of the order of 10^{-6} SI. In paramagnetic materials the electron shells are incomplete, and each atom has a magnetic moment due to the uncompensated electron orbits. When placed in a magnetic field, the electron orbits precess but the magnetic moment is aligned in the same direction as the applied field and produces susceptibilities of the order of 10^{-4} SI. Paramagnetism and diamagnetism exist only in the presence of the external magnetic field.

Some substances like iron, cobalt and nickel exhibit strong magnetic effects known as ferromagnetism and have much larger susceptibilities. In these magnetic materials, the atomic moments exhibit very strong interactions. These interactions are produced by electronic exchange forces and result in a parallel or antiparallel alignment of atomic moments even in the absence of an applied magnetic field. Ferromagnetic substances thus exhibit spontaneous magnetisation, and may carry a permanent magnetisation in the absence of an applied magnetic field. These spontaneous magnetisation regions have dimensions of the order 10^{-6} m and are called magnetic domains. The ordering of atomic moments within a domain may follow one of three patterns (Figure 1.2). In ferromagnetic minerals, the atomic moments are parallel. In antiferromagnetic minerals they are arranged on two equal antiparallel sublattices, so there is no residual moment. In the third type of mineral, the moments are arranged in two unequal sublattices, therefore the net magnetisation is not zero; this is ferrimagnetism.

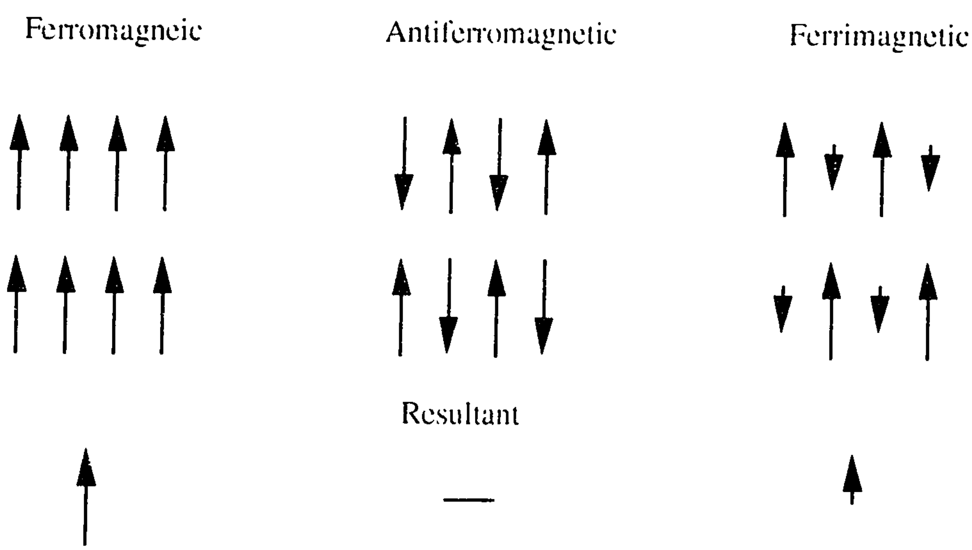

Figure 1.2. *The spontaneous magnetization vectors for three types of magnetism.*

As the temperature increases, thermal agitation may destroy the alignment. In ferromagnetic and ferrimagnetic minerals the spontaneous magnetisation falls as the temperature increases, disappearing at a critical temperature called the Curie temperature or Curie point, T_C; above T_C the substance behaves like an ordinary paramagnetic. In antiferromagnetic minerals the ordering is lost at the Néel temperature, T_N, above which the minerals are paramagnetic.

The smallest magnetic mineral particles contain only one domain. The larger particles contain many domains. The boundary between two domains is called a Bloch wall, which is a narrow zone within which the directions of the magnetisation of the electron spins cant over from that of one domain to that of the next (Figure 1.3). Magnetic crystals have "easy" and "hard" directions. Therefore, there are directions, along which it is easier for a substance to become magnetised than along another; this is referred to as magnetocrystalline anisotropy.

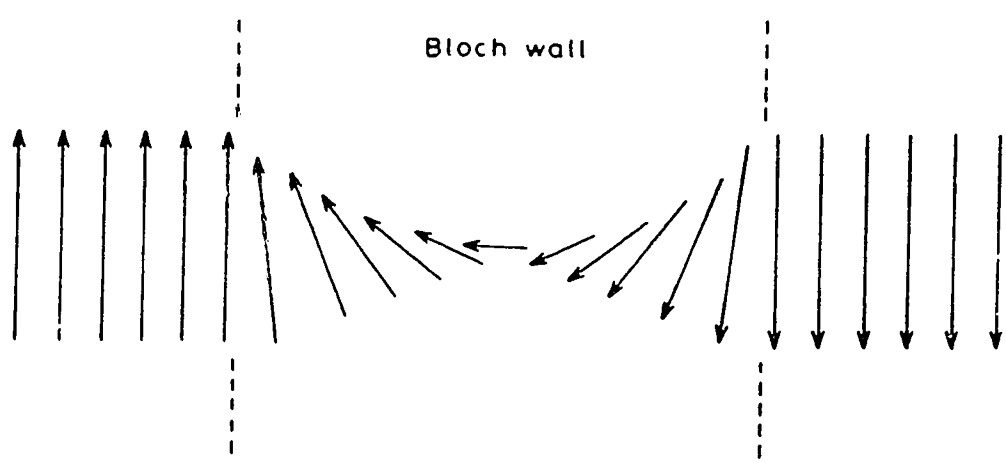

Figure 1.3. *Domain (Bloch) wall*

where $disX^2 = \sqrt{\sum_{i=1}^{4} (X_i - \overline{X})^2/4}$

and similarly for disY and disZ, and

$$RM = \sqrt{\overline{X}^2 + \overline{Y}^2 + \overline{Z}^2}$$

Thus, the angle θ conveniently describes the consistency of the six spins within each measurement. The smaller the angle, the more reliable are the results.

2.2.2 Demagnetisation

(a)Alternating field (AF) demagnetisation

In this project, the AF method has been applied to the initial magnetisation possessed by the samples upon collection (the so-called natural remanent magnetisation, NRM), and to the laboratory remanences anhysteretic remanent magnetisation (ARM) and saturation isothermal remanence (SIRM). In the AF method a sample is subjected to an alternating magnetic field that is smoothly reduced to zero from a pre-set peak value. The sample orientation is randomised by means of a pair of tumbling gears attached to the sample holder. The ambient field is annulled by two orthogonal pairs of coils carrying DC current. AF demagnetisation is useful for characterising the coercivity spectrum, the AF value needed to reduce the initial remanence by one half being referred to as the median destructive field (MDF, Figure 2.1).

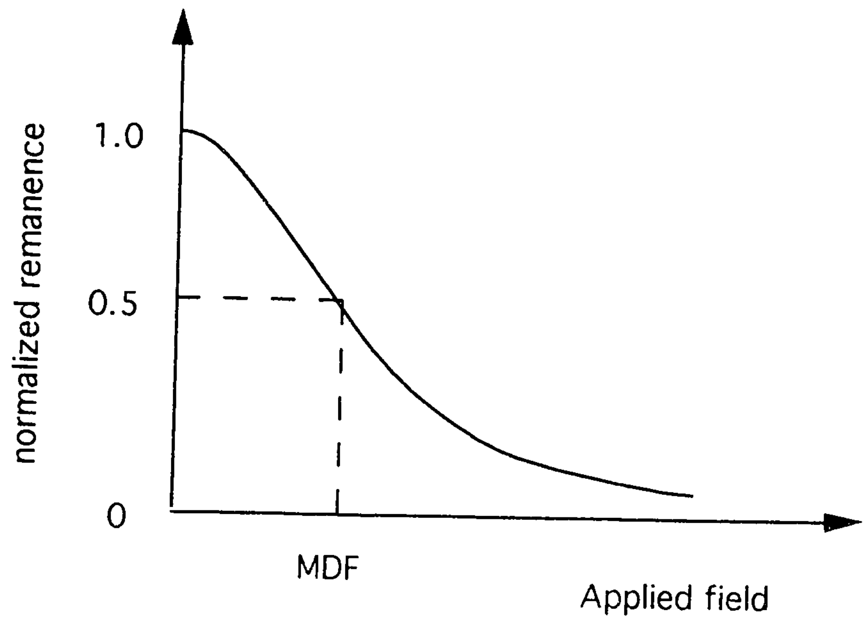

Figure 2.1. *AF demagnetisation curve*

(b) Thermal demagnetisation

From equation (1) (section 1.2), it is obvious that relaxation time is greatly dependent on temperature. When the temperature of a sample is increased, the relaxation time of the lower part of its blocking temperature spectrum is reduced to a time period of the same order as the laboratory experiment. If cooling takes place in a zero magnetic field, the remanence in this part will be removed and the unblocked fraction will not acquire a new TRM. In this project the samples were heated and cooled in a magnetically shielded room in which the ambient field is less than 60 nT (Maillol, 1992). After each temperature increment the remaining remanence was measured (Figure 2.2).

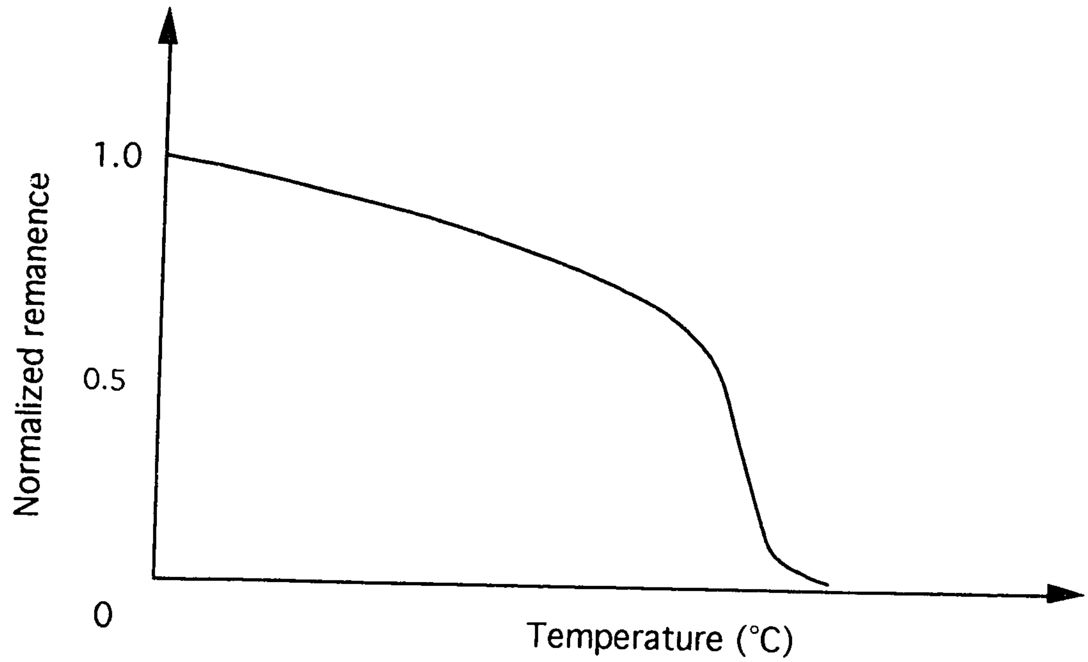

Figure 2.2. *Thermal demagnetisation curve*

2.2.3 Laboratory remanence acquisition

Two types of remanence acquisition experiment are involved in this project.

(a) ARM acquisition: The anhysteretic remanent magnetisation (ARM) is produced by the combined actions of a large AF and a smaller constant DC field. In this project, the AF peak value was 180mT and the DC field is 0.1mT.

(b) IRM acquisition: Isothermal remanent magnetisation (IRM) is the remanence left in the sample after a steady field has been applied for a short time (20 seconds) and then switched off. This steady field was increased from 0 to a maximum value (usually 1.2 T) step by step. After each step the remaining remanence is measured. The maximum remanence is the saturation isothermal remanence (SIRM) (Figure 2.3).

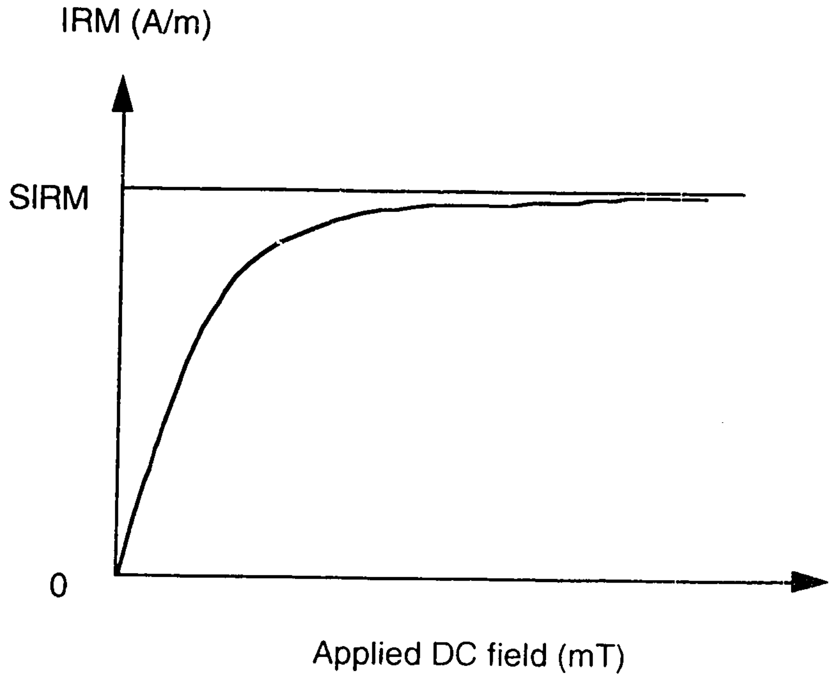

Figure 2.3. *IRM acquisition curve*

2.2.4 Backfield method

This procedure involves first giving a sample a saturation IRM (SIRM), and then successively increasing the DC field in the opposite sense to the SIRM. The back field required to reduce SIRM to zero is called the coercivity of remanence (H_{cr}) (Figure 2.4, see also Figure 1.4).

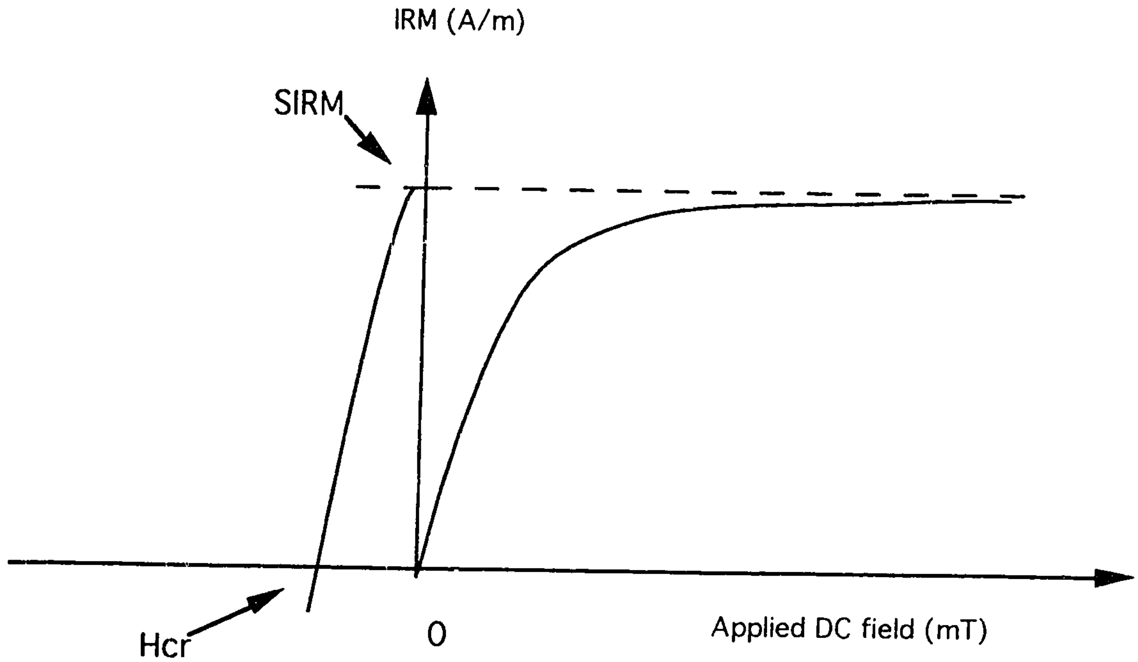

Figure 2.4. *Back field method*

Chapter 3 Results

3.1 Introduction

The magnetic properties of the samples described in Chapter 1 have been characterised by means of the techniques described in Chapter 2. All the measurement data can be found in Appendix A. The experiments performed on the individual samples are listed in Appendix B. In summary, the experiments involved are:

(a) AF demagnetisation of NRM (40 samples) (section 3.2 (a)).

(b) Thermal demagnetisation of NRM (22 samples) (section 3.2 (b)).

(c) ARM acquisition and its AF demagnetisation (20 samples) (section 3.2 (c)).

(d) IRM acquisition and backfield demagnetisation (33 samples) (section 3.2 (d)).

(e) AF demagnetisation of SIRM (10 samples) (section 3.2 (e)).

(f) Thermal demagnetisation of SIRM (5 samples) (section 3.2 (f)).

Since the primary aim of this project was to survey the relevant magnetic properties of representative archaeomagnetic samples, the results obtained are

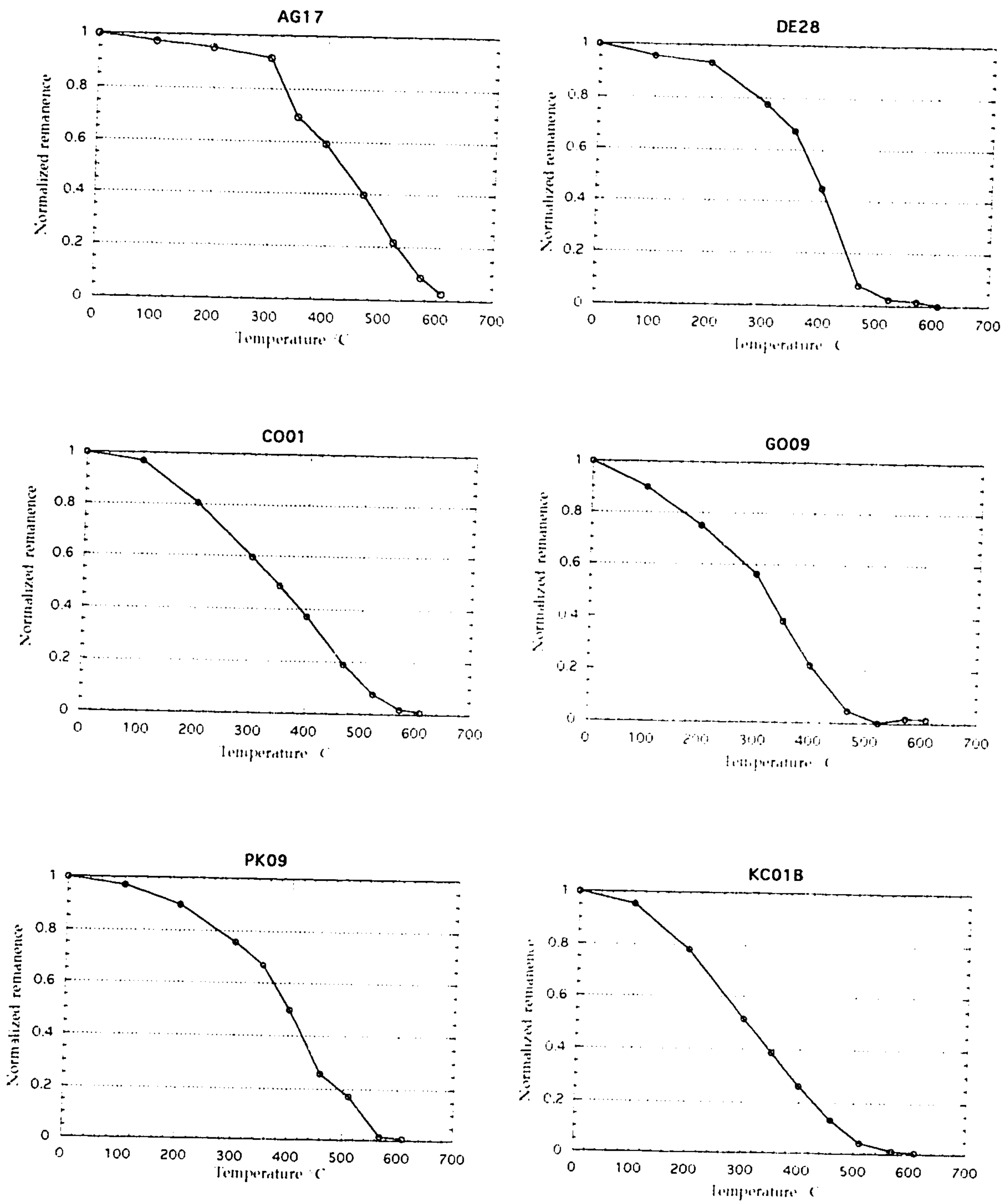

Figure 3.2.2a *Thermal demagnetisation of NRM of Greek samples*

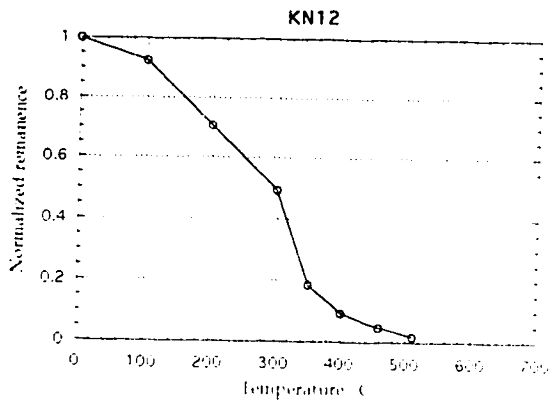

Figure 3.2.2a *Continued*

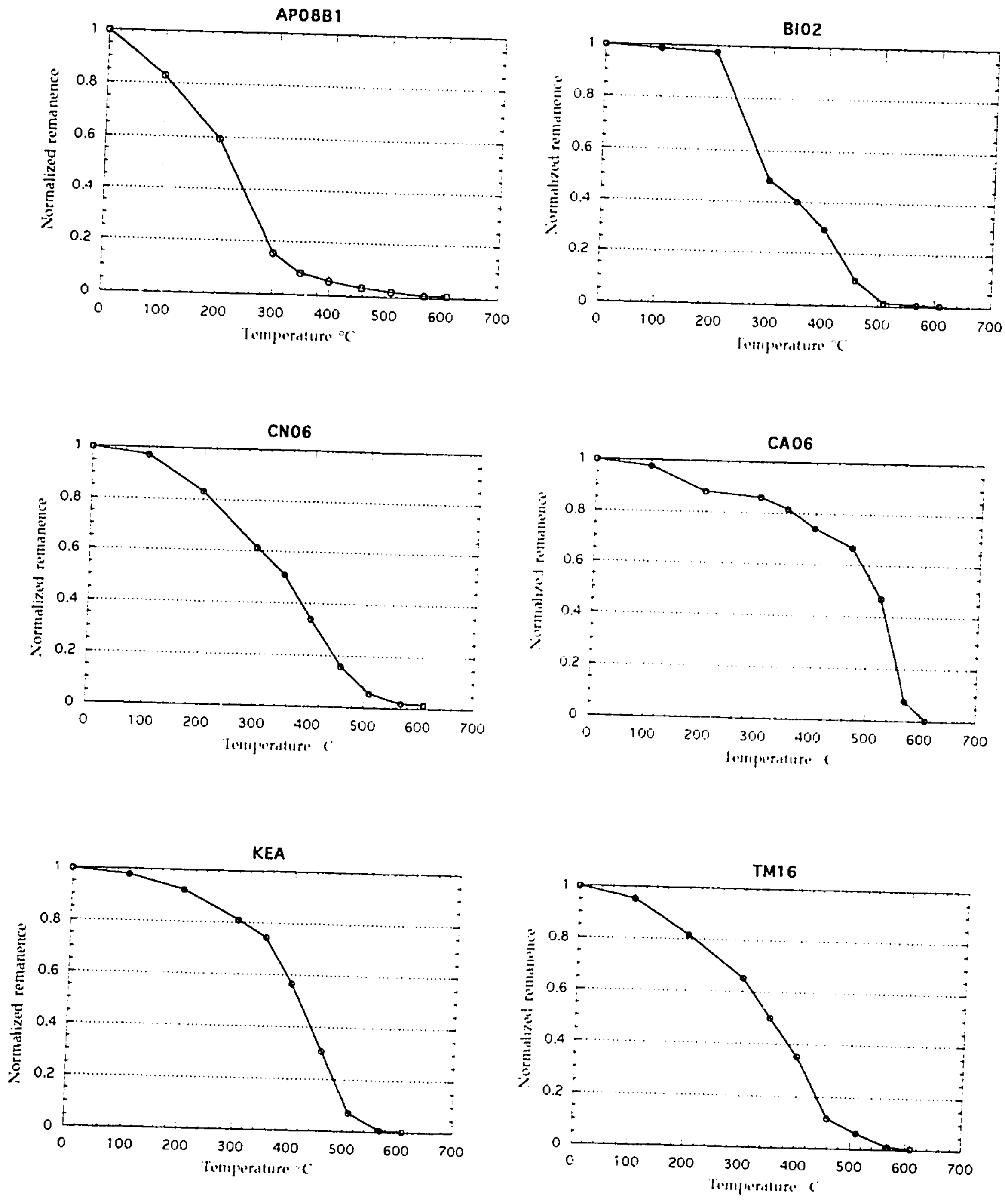

Figure 3.2.2b *Thermal demagnetisation of NRM of Italian samples*

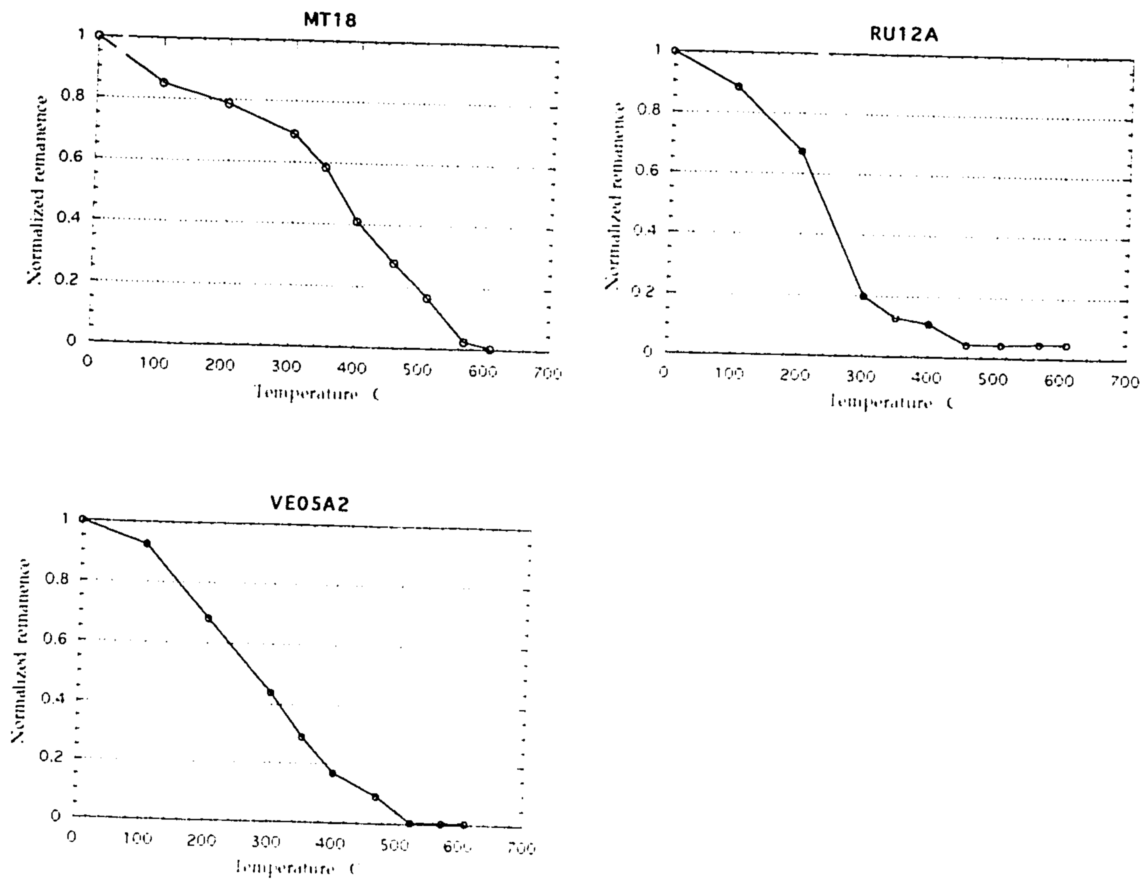

Figure 3.2.2b *Continued*

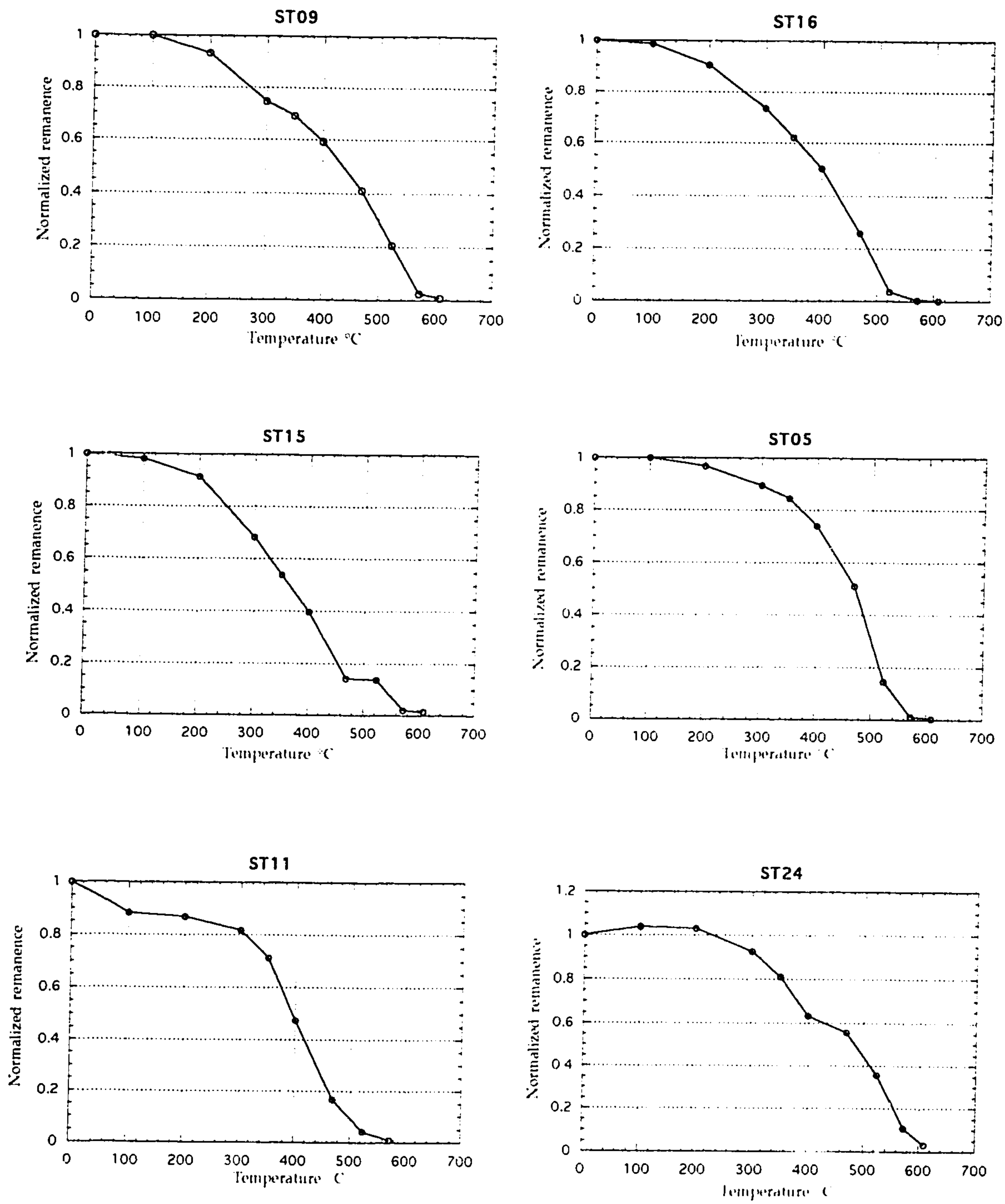

Figure 3.2.2c *Thermal demagnetisation of NRM of Chinese samples*

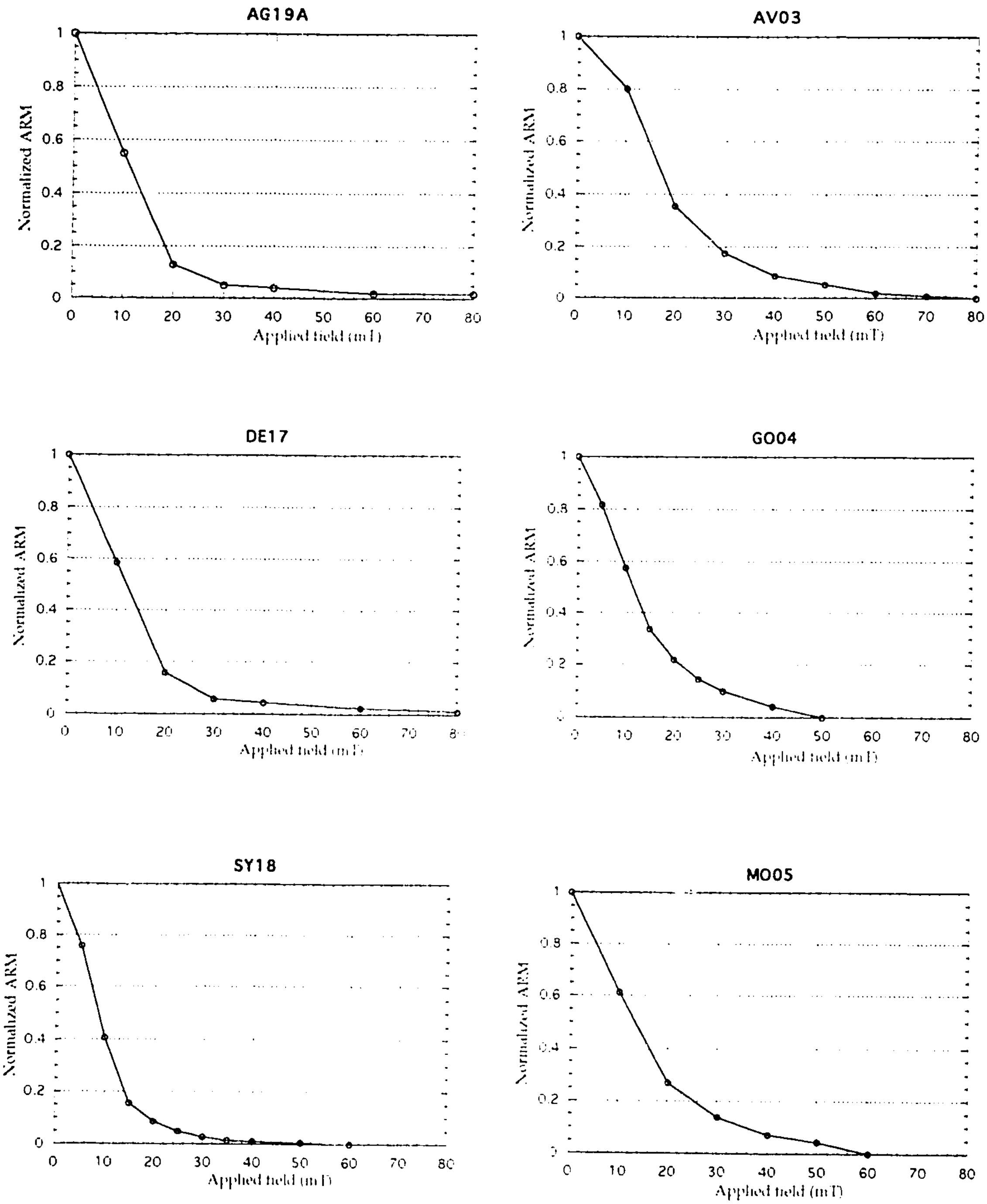

Figure3.2.3a *AF demagnetisation of ARM of Greek samples*

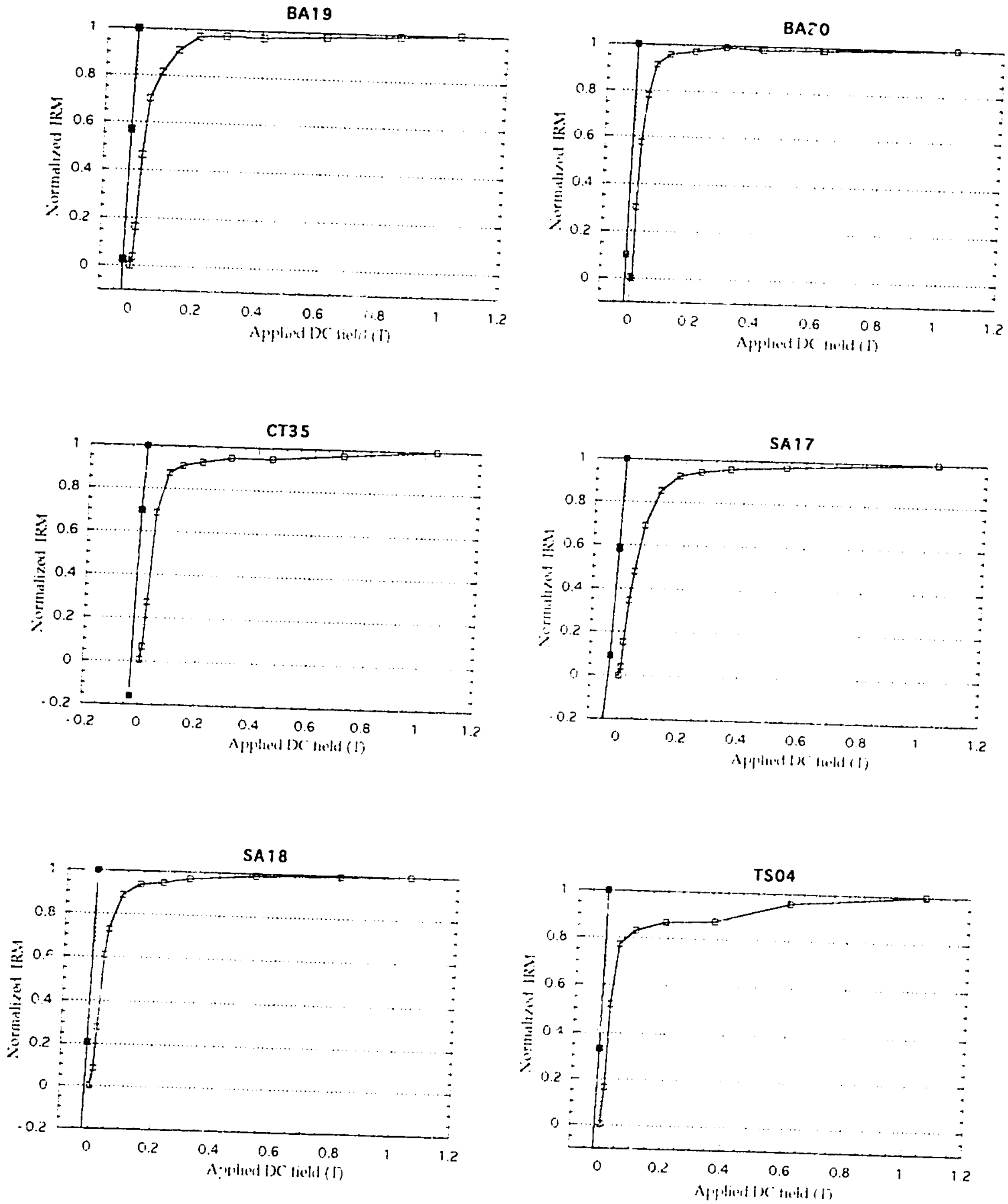

Figure 3.2.4d *IRM acquisition and back field results of North African samples*

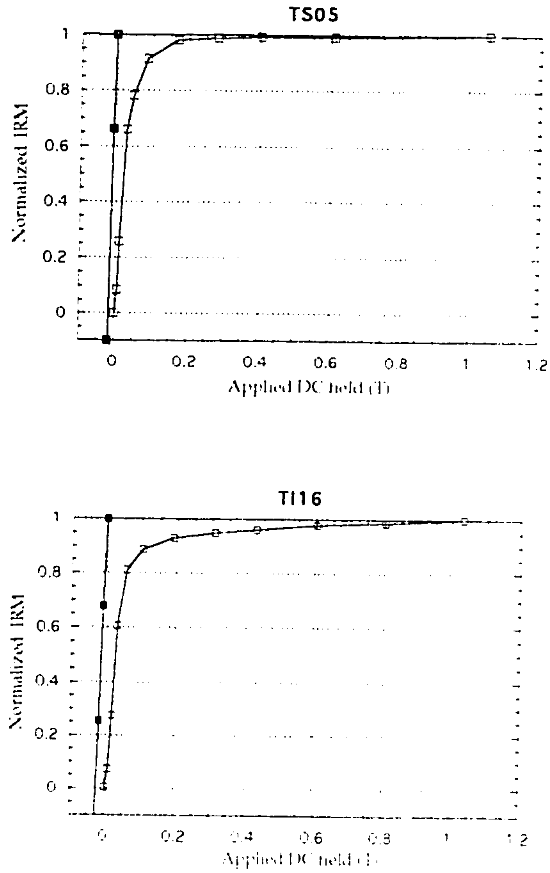

Figure 3.2.4d *Continued*

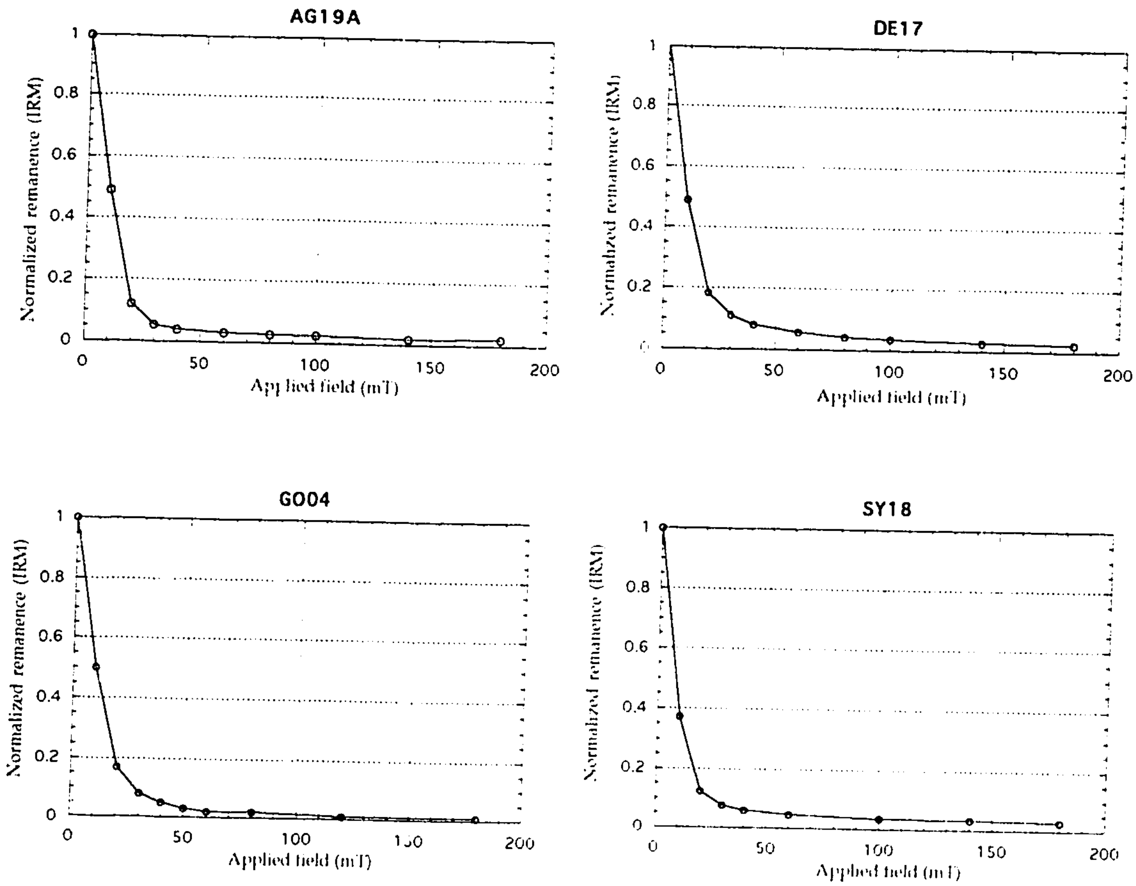

Figure 3.2.5a *AF demagnetisation of IRM of Greek samples*

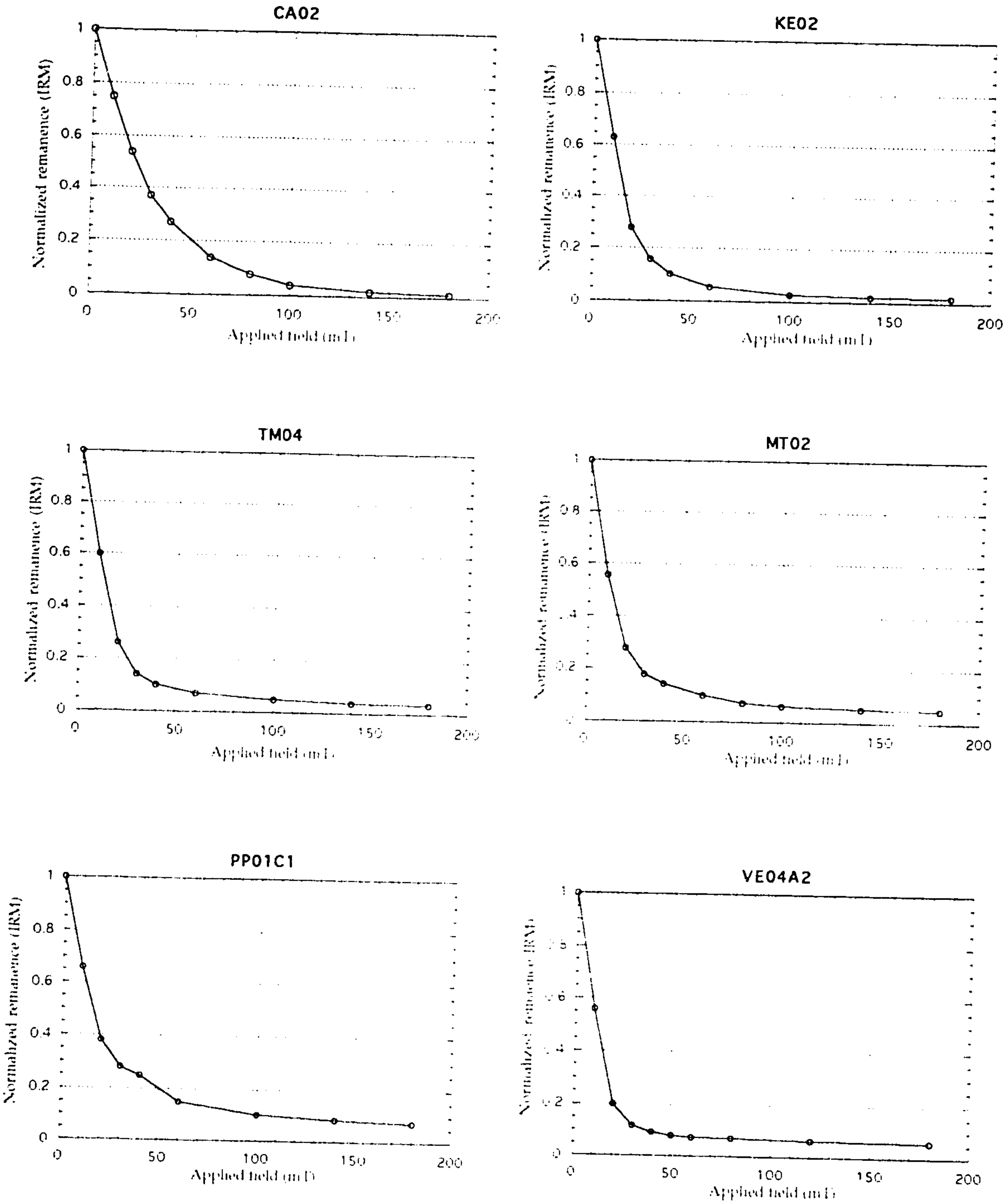

Figure 3.2.5b *AF demagnetisation of IRM of Italian samples*

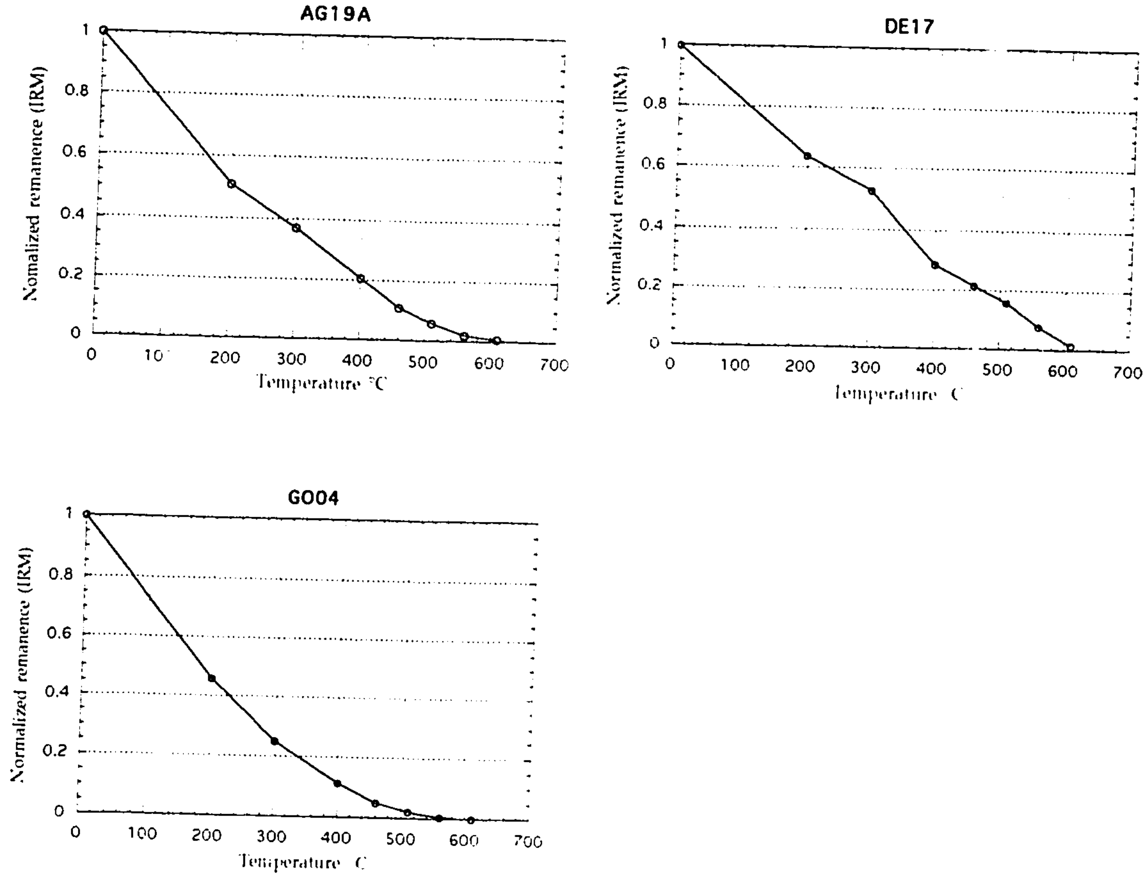

Figure 3.2.6a *Thermal demagnetisation of IRM of Greek samples*

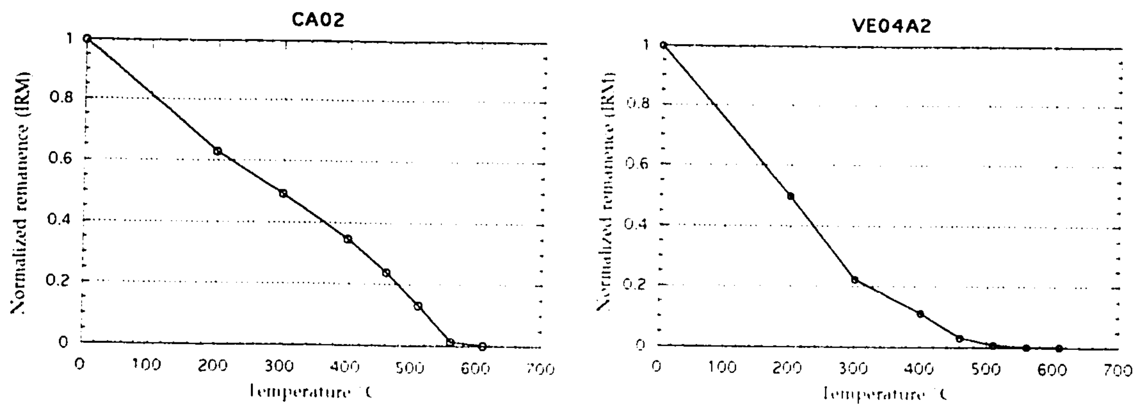

Figure 3.2.6b *Thermal demagnetisation of IRM of Italian samples*

Table 4.2.1 Δ values for 36 samples

Sample	Δ	Sample	Δ	Sample	Δ	Sample	Δ
KC12	0.043	CA02	0.024	CN09	0.058	SA18	0.031
CO04B	0.079	GR02	0.058	AP08A	0.074	SA17	0.047
AG19A	0.083	IN05	0.079	BI07	0.101	CT35	0.053
CR08	0.09	TM04	0.053	ST09	0.01	BA20	0.02
DE17	0.024	KE02	0.01	ST24	0.028	BA19	0.029
SY18	0.014	MT02	0.064	ST11	0.033	TS05	0.014
GO04	0.009	VE04A2	0.03	ST16	0.079	TI08	0.058
KN05	0.101	RU10B	0.079	ST15	0.028	TI16	0.053
PK06	0.038	SE04	0.02	ST05	0.014	TS04	0.14

4.2.2 Backfield

The coercivity of remanence, H_{cr}, is a useful magnetic parameter to identify minerals contained in samples. It is usually more convenient to measure H_{cr} than to measure H_c. The backfield method has been applied to 36 samples and the results are shown in Figure 3.2.4a-d. All H_{cr} values can be found in Table 4.2.2. The H_{cr} values for 34 samples are less than 50 mT. Only two samples (ST16 and ST11) have relatively high values (63 and 87mT) (Figure 4.2.2). Day et al (1976) studied synthetic titanomagnetites $[(1-x)\ Fe_3O_4]\ [xFe_2TiO_4]$ $(0 \le x \le 0.6)$ and found that H_{cr} values are in the range of 9 to 220 mT. The Hcr values for hematite are much higher, at least in the order of several hundred mT (Irving, 1964; Dankers, 1981). Therefore, it is reasonable to consider that the main magnetic minerals contained in these samples are magnetite and/or titanomagnetite.

Table 4.2.2 Hcr (mT) values for 36 samples

Sample	Hcr	Sample	Hcr	Sample	Hcr	Sample	Hcr
KC12	20	CA02	35	CN09	27	SA18	13
CO04B	23	GR02	47	AP08A	12	SA17	31
AG19A	14	IN05	20	BI07	8	CT35	25
CR08	8	TM04	21	ST09	31	BA20	13
DE17	14	KE02	21	ST24	48	BA19	24
SY18	9	MT02	19	ST11	63	TS05	10
GO04	14	VE04A2	17	ST16	87	TI08	13
KN05	47	RU10B	17	ST15	32	TI16	20
PK06	20	SE04	17	ST05	49	TS04	13

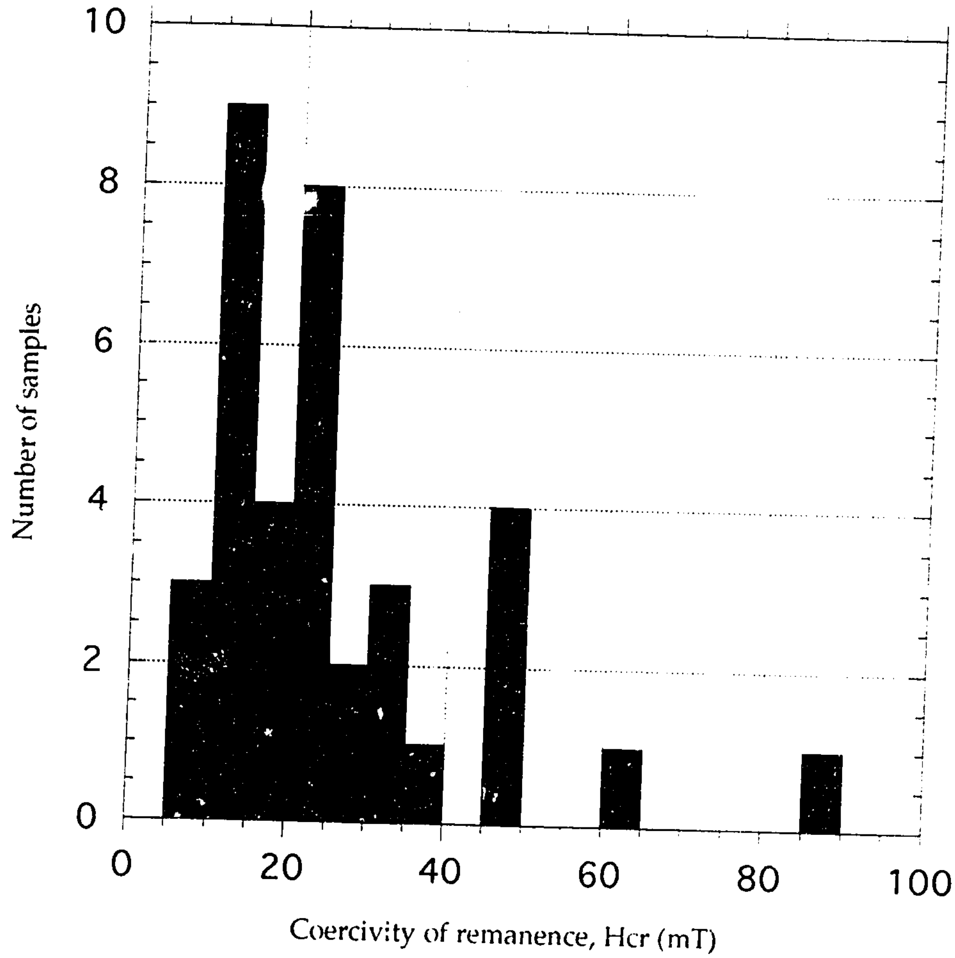

Figure 4.2.2 Histogram of Hcr for 36 samples

4.2.3 AF demagnetisation of IRM

Ten samples were investigated using AF demagnetisation of saturation IRM (Figure 3.2.5a and b). From these results, we obtain the values of median destructive field of IRM (MDF of IRM) (Table 4.2.3). The MDF of IRM values for 9 out of 10 are in the range of 7 - 16mT and the remaining one (CA02) is 22mT (Figure 4 2.3). Dankers (1981) studied the MDF of IRM for hematite, magnetite and titanomagnetite with different compositions. His results are: the MDF of IRM values for hematite are in the range 53 - 285mT; the MDF of IRM values for magnetite and titanomagnetite are in the range 5 - 19mT. Comparing our results with those of Dankers, it is clear that the main magnetic mineral contained in the 10 samples is magnetite and/or titanomagnetite, hematite being either absent or negligible.

Table 4.2.3 MDF of IRM values for 10 samples

Sample	MDF (mT)	Sample	MDF (mT)
VE04A2	12	SY18	7
PP01C1	15	GO04	10
AG19A	10	KE02	13
CA02	22	TM04	12
DE17	10	MT02	11

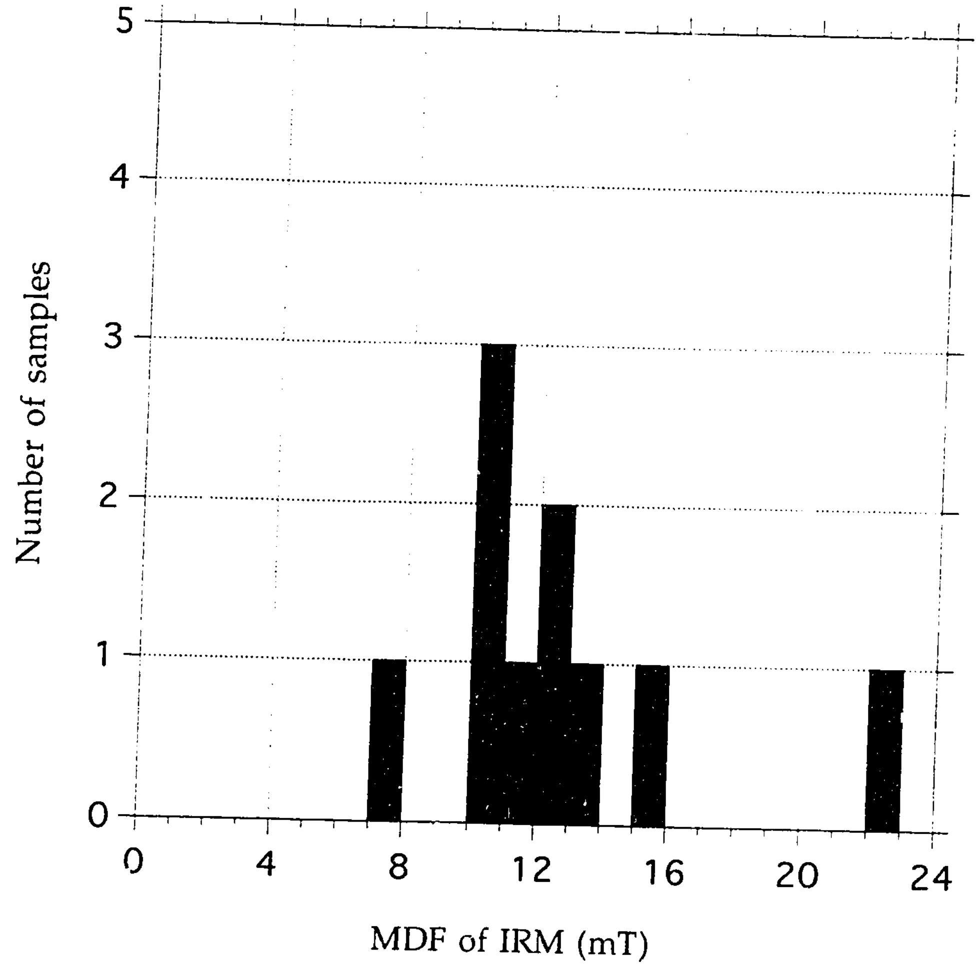

Figure 4.2.3 Histogram of MDF of IRM for 10 samples

4.2.4 AF demagnetisation of ARM

AF demagnetisation of ARM has been performed on 20 samples. The results are presented in Figure 3.2.3a-c. The values of median destructive field (MDF) of ARM are listed in Table 4 2.4. Most samples (18 out of 20 samples) have low values of MDF of ARM (between 11 - 33mT) (Figure 4.2.4). The other two ST05 and ST16) have the values of 38 and 48mT respectively. The MDF of ARM has been investigated by Maher (1988), by Levi et al (1976) and by Johnson et al (1974). The MDF of ARM values for magnetite with different grain size are in the range of 3 - 67mT. I could not find any corresponding values published for hematite.

Table 4.2.4 MDF of ARM (mT) values for 20 samples

Sample	MDF	Sample	MDF	Sample	MDF	Sample	MDF
CA02	14	MT02	11	AG19A	11	ST11	33
IN08	12	GR04	32	GO04	12	ST05	38
KE02	14	VE04A2	12	DE17	12	ST15	20
TM04	13	SY18	9	MO05	13	ST16	48
PP01C1	14	AV03	17	ST24	28	ST09	19

1	2	3	4	5
0	1E-05	328	68	44.1
21	8E-05	149	88	7.4
42	0.0002	167	88	8.5
80	0.0002	130	88	9.6
123	0.0003	92	89	11
161	0.0004	102	88	11.3
200	0.0004	131	89	12.6
250	0.0004	134	89	11.6
400	0.0004	116	88	13.4
500	0.0004	117	88	13.8
600	0.0004	158	88	13.6
750	0.0004	105	88	14
900	0.0005	110	89	14.2
1111	0.0005	119	88	14.2
1433	0.0005	111	88	14.2

1293	0.451	22	89	4.1

PK06

1	2	3	4	5
0	0.0049	73	-27	8.3
29	0.487	249	83	2.9
41	0.61	262	85	1.8
66	0.717	252	83	1.5
86	0.733	247	86	1.4
139	0.747	304	89	1.7
199	0.751	245	87	1.8
303	0.756	229	83	2.1
500	0.759	194	88	1.8
750	0.769	319	88	1.6
1000	0.775	298	87	1.5
1314	0.786	201	87	2.1

SY18

1	2	3	4	5
0	0.003	140	69	4.2
18	0.141	92	89	3.9
31	0.221	107	87	3
55	0.253	133	88	3.7
91	0.269	120	89	4.4
156	0.273	358	89	4.3
251	0.276	109	89	4.1
351	0.277	114	88	4.3
600	0.277	106	88	4.5
900	0.278	108	87	4.2
1397	0.281	25	88	3.5

AP08A

1	2	3	4	5
0	0.0002	198	53	3.9
18	0.0235	317	-89	6.4
35	0.0334	96	-88	2.1
87	0.0393	315	-88	1.6
140	0.0413	290	-88	1.6
232	0.0423	53	-88	1.5
352	0.0427	331	-89	1.3
500	0.0433	297	-87	1.4
707	0.044	7	-88	1.4
957	0.0444	292	-86	1.6
1325	0.0457	350	-89	2.2

BI07

1	2	3	4	5
0	0.0001	282	-63	10.8
22	0.0145	189	88	5.9
40	0.0157	216	87	2.6
80	0.0165	152	88	1.9
122	0.017	159	88	1.3
161	0.0172	206	87	1.6
220	0.0175	183	88	1.4
270	0.0176	257	89	1
340	0.0179	181	86	1.6
423	0.0179	147	88	1.3
550	0.0181	247	90	1.4
700	0.0182	238	87	1.4
900	0.0184	178	88	1.4

CA02

1	2	3	4	5
0	0.001	126	2	2.1
18	0.054	307	88	1.5
36	0.124	126	88	1.6
57	0.195	184	90	1.3
90	0.281	152	87	3.1
121	0.313	139	87	3
171	0.33	139	87	1.3
229	0.341	70	89	1.5
300	0.346	121	88	1.2
431	0.349	152	89	1.2
601	0.352	108	88	1.7
851	0.354	127	88	1.5
1102	0.354	115	88	1.3

1123	0.0195	145	88	3.9

CN09

1	2	3	4	5
0	0.003	118	14	3.9
19	0.0957	146	87	2
29	0.181	190	84	3.5
40	0.251	231	86	0.7
55	0.306	265	86	2.5
69	0.345	267	87	0.7
80	0.373	260	88	4.2
93	0.378	245	89	2.2
112	0.383	242	89	1
138	0.397	162	89	1.8
161	0.397	238	88	0.8
196	0.407	202	89	2.2
270	0.403	124	88	0.8
400	0.409	206	89	0.9
550	0.414	153	89	0.7
700	0.418	229	89	0.9
880	0.422	135	90	0.6
1084	0.425	157	89	0.9
1309	0.429	229	89	0.7

KE02

1	2	3	4	5
0	0.002	20	69	9.1
19	0.097	294	84	5.1
34	0.206	181	87	4.7
60	0.27	165	86	3
89	0.299	167	87	4.8
120	0.309	181	89	2.3
184	0.316	295	89	3
281	0.317	99	90	3.6
400	0.32	174	86	2.1
865	0.322	125	88	2
1101	0.322	206	88	1.9
1384	0.322	76	89	3.5

MT02

1	2	3	4	5
0	0.001	122	7	4.7
18	0.029	126	88	1.4
31	0.049	177	85	2.3
58	0.065	239	88	1
102	0.072	223	87	1.1

1275	0.354	122	88	1.3

IN05

1	2	3	4	5
0	0.0043	83	55	3.2
21	0.166	9	82	2.5
31	0.232	316	88	5.5
43	0.294	205	87	6.1
58	0.335	320	87	2.8
78	0.37	360	89	3.3
93	0.379	271	85	6.5
112	0.389	284	87	6
136	0.397	249	88	8.4
159	0.395	289	86	9.1
184	0.4	285	86	6.2
220	0.404	262	85	6.8
250	0.409	274	84	6.6
300	0.411	258	85	5.9
400	0.418	257	85	4.7
550	0.421	275	85	4.2
751	0.422	313	84	3.2
956	0.43	251	85	1.3
1159	0.435	300	84	5.2
1341	0.443	271	86	9.6

TM04

1	2	3	4	5
0	0.002	40	70	5.4
19	0.157	254	87	4.2
35	0.273	194	86	3.4
53	0.334	199	86	4.1
91	0.366	211	87	3.7
151	0.378	86	88	4
230	0.382	163	89	4
300	0.385	185	87	3.6
401	0.394	150	88	4.7
553	0.399	176	88	5.3
700	0.4	172	87	4.4
950	0.401	78	89	5.6
1400	0.404	173	88	4

RU10B

1	2	3	4	5
0	0.0038	340	-46	4.9
20	0.322	237	79	1.2
32	0.551	214	85	4

151	0.075	195	86	1.1
237	0.076	194	87	1.1
331	0.076	216	87	1.1
503	0.078	170	86	1.6
700	0.078	150	87	1.2
700	0.078	170	88	1.2
901	0.079	151	88	1.1
1278	0.081	164	88	1.6

GR02

1	2	3	4	5
0	0.0002	90	54	14.4
17	0.0057	198	86	13.7
31	0.0237	209	89	11.4
52	0.0544	77	85	12
72	0.0761	81	87	10.2
110	0.0944	160	84	12.2
151	0.109	340	85	10.7
199	0.113	306	89	8.6
300	0.115	356	90	7.8
500	0.122	50	86	10.9
701	0.122	86	87	12.5
1006	0.122	110	88	10.5
1307	0.122	83	88	10.1

VE04A2

1	2	3	4	5
0	0.002	64	21	5.2
20	0.105	260	85	8.9
55	0.171	356	89	5.2
85	0.186	263	86	5
120	0.187	60	89	2.9
200	0.191	295	89	3.1
300	0.191	255	87	4.7
512	0.195	273	88	5.2
800	0.196	306	89	4.7
1390	0.197	280	86	3.7

ST11

1	2	3	4	5
10	0.0005	105	82	4.3
19	0.0024	59	89	3.4
35	0.0091	37	84	3.1
73	0.0248	165	89	3.2
124	0.037	63	81	4.1
175	0.043	45	83	2.8

42	0.662	225	84	1.4
58	0.745	230	85	1.4
70	0.778	183	88	1.5
90	0.802	207	86	1.6
110	0.81	209	86	1.4
150	0.814	216	88	1.6
230	0.823	206	87	1.5
400	0.855	202	86	2.2
600	0.859	201	87	1.8
849	0.895	159	87	1.7
1103	0.898	164	88	1.8
1250	0.901	198	85	1.6

SE04

1	2	3	4	5
0	0.001	108	39	5.7
19	0.0844	265	84	1.8
32	0.185	247	79	2.2
53	0.312	209	85	3.1
81	0.378	201	85	2.4
121	0.401	116	89	1.7
171	0.413	150	87	2.6
260	0.42	180	88	2.3
400	0.421	162	86	2.4
600	0.416	144	87	2.3
801	0.42	181	89	1.6
1051	0.425	164	87	1.5
1304	0.427	250	88	1.5

ST09

1	2	3	4	5
0	0.0002	9	21	7.5
8	0.0071	302	87	5.7
13	0.0374	354	86	5.4
38	0.132	62	88	3.8
52	0.193	109	85	6.9
95	0.27	55	87	3.5
162	0.311	354	87	3.5
225	0.327	314	87	3.7
299	0.331	306	88	3.1
463	0.325	292	88	3.7
704	0.327	269	86	3.4
1010	0.327	277	87	3.6
1408	0.327	278	88	3.7

ST16

270	0.0474	13	86	2.5
410	0.049	17	83	2.5
614	0.0492	30	87	2.6
815	0.0492	356	86	2.8
1419	0.0492	24	84	2.6

ST15

1	2	3	4	5
0	0.0002	9	-16	7.5
4	0.0043	295	87	2.9
10	0.0149	308	87	2
17	0.0441	41	87	2.4
32	0.131	1	87	7.1
48	0.183	196	89	2
72	0.239	294	89	1.8
110	0.299	247	88	2.4
161	0.32	329	88	1.9
233	0.332	320	89	1.9
334	0.336	273	88	1.9
531	0.339	270	87	2.2
811	0.342	283	87	2.4
1419	0.345	291	88	2.2

ST24

1	2	3	4	5
0	0.0001	45	10	6.4
7	0.004	38	83	6.4
20	0.0298	4	82	5.7
35	0.0692	13	83	4.8
73	0.155	27	85	6
131	0.241	35	81	5.3
214	0.252	31	81	4.5
369	0.261	23	80	4.3
519	0.262	40	81	5.5
800	0.262	28	81	4.2
1417	0.264	41	82	4.1

BA20

1	2	3	4	5
0	0.0024	143	45	5.7
8	0.0006	63	87	3.7
14	0.153	321	87	4.6
22	0.291	77	85	3.1
40	0.396	62	89	7
65	0.462	358	87	4.1
107	0.485	334	88	3.2

1	2	3	4	5
0	0.0022	341	-21	6
9	0.0029	342	-46	3.4
20	0.0129	343	-86	4.1
37	0.0503	57	-88	3.3
79	0.221	220	-85	3.3
130	0.463	212	-81	4.3
197	0.56	168	-86	3.2
267	0.587	228	-87	3.7
391	0.637	143	-86	3.4
583	0.646	164	-87	3.4
859	0.648	134	-86	3.5
1400	0.648	149	-87	3.2

ST05

1	2	3	4	5
0	0.0005	332	-16	6.4
74	0.498	223	88	1.6
93	0.626	160	87	1.6
152	0.772	113	86	1.7
209	0.804	110	88	1.8
300	0.822	86	86	1.8
462	0.828	199	89	2.1
646	0.829	21	88	1.7
951	0.832	235	88	2.2
1410	0.831	265	89	2.2

BA19

1	2	3	4	5
0	0.0016	57	57	7.9
6	0.0169	113	83	9
13	0.0719	143	83	2
26	0.201	131	87	0.7
43	0.306	144	83	2.7
82	0.356	155	83	5.6
133	0.397	160	84	0.8
197	0.423	148	86	3.9
284	0.425	164	84	1.5
404	0.424	158	84	1
608	0.428	151	84	0.9
850	0.432	149	84	0.9
1047	0.436	156	87	1

CT35

1	2	3	4	5
0	0.0005	295	18	4.9

190	0.492	315	88	3.2
290	0.502	304	88	2.9
413	0.498	313	88	3.3
613	0.5	296	86	3.4
1045	0.506	304	88	3.3

SA17

1	2	3	4	5
0	0.0025	287	50	8.7
8	0.042	282	85	6.8
14	0.158	309	88	7.7
27	0.358	338	88	3.6
42	0.497	324	87	3.3
71	0.718	339	87	2.7
120	0.889	335	88	2.8
181	0.96	325	87	2.6
252	0.981	328	88	2.4
350	0.997	320	87	2.5
536	1.01	309	87	2.3
1036	1.04	299	87	2.9

TS04

1	2	3	4	5
0	0.0006	339	23	2.6
8	0.0276	71	86	2.3
20	0.0872	71	86	2.4
44	0.13	99	87	2.2
95	0.14	91	88	4.6
196	0.146	75	88	1.8
358	0.147	80	88	2
604	0.161	75	89	4.1
1053	0.168	65	88	4.6

TI08

1	2	3	4	5
0	0.0014	244	67	6.4
6	0.0063	222	89	2.5
17	0.0338	172	89	2.8
27	0.066	3	86	3
40	0.0906	129	87	3.4
67	0.105	311	89	3
101	0.109	338	88	6.9
177	0.113	329	86	3
276	0.116	293	84	6.6
404	0.118	300	87	3.1
609	0.12	288	86	3.3

8	0.0039	316	86	4.6
19	0.016	71	86	4.9
42	0.0402	80	86	3.8
82	0.051	82	85	3.7
130	0.053	89	88	3.8
199	0.0541	94	87	3.7
303	0.0554	89	88	4.2
450	0.0554	84	88	3.6
7[illegible]6	0.0568	316	89	3.5
1040	0.0584	125	89	3.7

SA18

1	2	3	4	5
0	0.0008	25	29	6.4
8	0.019	22	87	9.5
15	0.0633	91	86	6.2
31	0.138	76	85	5.2
44	0.165	56	89	5.6
83	0.201	57	88	5.4
142	0.212	201	89	6.3
218	0.23	37	89	5.8
303	0.229	22	89	5.4
522	0.224	40	90	5.4
803	0.225	315	89	5
1040	0.226	69	90	5.3

TS05

1	2	3	4	5
0	0.0008	13	61	2.2
7	0.0584	216	-89	2.5
13	0.176	254	-87	2.1
30	0.45	252	-84	2.7
47	0.532	212	-88	2.8
86	0.621	238	-87	3.7
170	0.667	190	-89	3.3
282	0.672	175	-89	3.4
404	0.675	245	-88	4.6
612	0.676	115	-89	3.4
1052	0.68	168	-89	3.5

804	0.122	300	86	2.5
1045	0.123	335	87	3.1

TI16

1	2	3	4	5
0	0.0015	313	48	4.5
8	0.0351	32	87	2.9
18	0.134	69	88	2.4
32	0.294	74	83	2.4
57	0.395	102	84	2.8
102	0.432	83	86	3
189	0.452	77	88	2.9
307	0.461	78	88	3.1
427	0.467	91	88	2.8
602	0.476	92	86	2.9
801	0.481	13	89	2.8
1030	0.486	109	88	3

Experiment 4 (p91 - 93)

AG19A

1	2	3	4	5
0	0.369	87	87.3	5.9
5	0.275	112.7	87.1	5.8
10	0.141	104.6	88.8	5.5
17	-0.027	92.2	-74.5	11.5
22	-0.132	84.9	-84.9	7.3

CR08

1	2	3	4	5
0	0.16	230	87	11.2
11	0.0257	261	76	3.9
29	-0.105	26	-84	12

GO04

1	2	3	4	5
0	0.546	134.3	88.2	3.6
8	0.283	111.3	86.9	5.8
13	0.065	53.4	53.5	14.8
16	-0.048	61.1	-49	10.5
20	-0.166	81.2	-85.2	10.3

PK06

1	2	3	4	5
0	0.775	55	86.8	2.6
13.8	0.293	139.5	87.1	3.2
51	-0.624	262.6	-84.1	2.9

AP08A

1	2	3	4	5
0	0.045	303	-88	1.9
12	0.0069	129	-85	7.6
35	-0.028	360	88	1.8

CN09

1	2	3	4	5
0	0.42	218	-88	1
10	0.303	234	-88	1.5
28	0.0313	78	-2	2.4
46	-0.183	46	77	4.3

IN05

1	2	3	4	5
0	0.448	358	89	3.1

CO04B

1	2	3	4	5
0	0.108	77.4	-86.9	4
10	0.0866	87.1	-83.5	4.5
30	-0.025	73.5	83.2	9.5

DE17

1	2	3	4	5
0	0.056	235	88	2.1
8	0.03	133	88	2.8
14	0.01	72	60	5.9
24	-0.018	78	-75	3.5

KC12

1	2	3	4	5
0	0.46	230	88	5.2
13	0.183	265	71	7.7
30	-0.141	294	-86	7

KN05

1	2	3	4	5
0	0.0004	357	86	9.7
13	0.0003	15	88	12.4
50	-1E-05	311	-21	90

SY18

1	2	3	4	5
0	0.289	245.4	86.7	4.6
10.6	0.0686	224.5	84.6	3.6
23.3	-0.125	255.9	-86.4	5.1

BI07

1	2	3	4	5
0	0.0158	184	-89	3
11	0.0014	115	67	22.6
27	-0.009	100	88	6.2

CA02

1	2	3	4	5
0	0.354	85.4	87.2	1.5
9	0.272	85.1	85.8	1.9
20	0.156	86.7	84.3	3.3
33	0.048	97.4	64.8	4.4
44	-0.038	90.5	-58.9	3.1

10	0.286	3	89	3.3
24	-0.032	91	-76	3.6

KE02

1	**2**	**3**	**4**	**5**
0	0.31	331	-89.3	1.5
8.6	0.23	303.6	-89.2	1.2
25	-0.055	89.2	65.5	12.8

MT02

1	**2**	**3**	**4**	**5**
0	0.0843	223	-89	7.5
11	0.0355	12	-89	1.9
26	-0.023	61	78	4.6

GR02

1	**2**	**3**	**4**	**5**
0	0.108	19	-89	7.8
10	0.0951	12	-85	9.5
27	0.0491	110	-85	4
82	-0.068	40	80	21.6

VE04A2

1	**2**	**3**	**4**	**5**
0	0.195	252.4	86.1	0.9
7	0.143	257.1	86.9	1.1
13	0.06	41.6	83.1	1.8
21	-0.037	84.8	-81.2	1.8

ST15

1	**2**	**3**	**4**	**5**
0	0.334	262	85	2.1
15	0.213	260	83	2.1
32	0.0231	263	57	3.4
43	-0.054	278	-78	3.8

ST05

1	**2**	**3**	**4**	**5**
0	0.829	195.3	-89.2	2.3
10.1	0.703	194.3	-88.3	2.4
34.7	0.293	122.1	-77	7.1
51.6	-0.071	129.4	22.4	12.9

ST24

1	**2**	**3**	**4**	**5**
0	0.255	30.5	80.8	7.7
13.3	0.209	30.7	79.9	5.5

TM04

1	**2**	**3**	**4**	**5**
0	0.401	9.5	88.3	3.4
12	0.18	110.6	88.7	5.8
26	-0.094	159.8	-82.8	7.6

RU10B

1	**2**	**3**	**4**	**5**
0	0.897	133	-88	2.8
11	0.53	102	-87	3.7
27	-0.131	79	62	1.6

SE04

1	**2**	**3**	**4**	**5**
0	0.432	342	88	2.4
14	0.208	257	85	4.6
27	-0.035	274	-67	5.6

ST09

1	**2**	**3**	**4**	**5**
0	0.325	88	-86	3.6
13	0.2	90	-84	11.6
39	-0.048	276	69	7.3

ST16

1	**2**	**3**	**4**	**5**
0	0.654	166	-88	3.2
10	0.632	115	-88	3.2
20	0.587	111	-87	3
30	0.504	104	-86	3.4
40	0.396	94	-83	3.6
70	0.163	78	-74	6.7
120	-0.225	350	76	3.3

ST11

1	**2**	**3**	**4**	**5**
0	0.0486	193.8	-82.4	2.5
12.4	0.0406	185.5	-85	2.6
32.7	0.0248	188.5	-85	2.6
51.9	0.0091	94.6	-44.9	5.3
65.3	-0.004	85.2	21.2	9.5

BA19

1	**2**	**3**	**4**	**5**

32.5	0.0745	18.1	83.4	4.5
46.1	0.0148	277.8	21.4	10
55	-0.037	263.2	-78.8	6.2

BA20

1	2	3	4	5
0	0.502	144	-87.4	3.5
13.5	0.05	269.9	-58.5	2.3
28.3	-0.262	40.1	89	3.2

SA17

1	2	3	4	5
0	0.1932	303	87	2.4
12	0.1121	287	85	3.4
28	0.0175	279	64	14.2
50	-0.049	205	-84	6.1

TS04

1	2	3	4	5
0	0.167	4.1	88.2	3.8
11	0.0551	307.7	87.4	2.3
25.5	-0.055	179.2	-88.3	2.5

TI08

1	2	3	4	5
0	0.121	147.1	-88.1	3.3
12.3	0.046	101.3	-81.4	5.8
28.2	-0.04	82.7	74.2	4.3

0	0.441	156	84	4
11	0.25	151	83	8.2
23	0.0117	132	45	6.5
42	-0.284	40	-87	1.4

CT35

1	2	3	4	5
0	0.0577	123.1	88.6	3.6
11.9	0.0403	287.4	89.7	3.5
31.9	-0.009	273.1	-68.3	5.7

SA18

1	2	3	4	5
0	0.232	253.9	-88.8	5.9
13	0.0486	113.7	-74.4	7.2
27.8	-0.081	92.5	89.2	10.8

TS05

1	2	3	4	5
0	0.679	194.8	-88	3.9
7.6	0.45	194.5	-87.6	4.6
18.3	-0.065	120.6	63.5	13.7

TI16

1	2	3	4	5
0	0.484	39.9	89.7	2.6
9.2	0.329	283.3	89	3.2
18.1	0.123	269.7	82.6	4.9
39.5	-0.248	254.3	-78.3	1.9

Experiment 5 (p94 - 95)

AG19A

1	2	3	4	5
0	0.361	47	89	6.1
10	0.177	269	89	5.9
20	0.0436	235	88	5.7
30	0.0199	226	87	5.7
40	0.0145	233	85	5.4
60	0.0111	193	87	4.5
80	0.0097	249	87	5.7
100	0.0091	163	89	6.3
140	0.0074	201	86	3.5
180	0.008	218	87	8.9

GO04

1	2	3	4	5
0	0.525	149	89	3.6
10	0.263	171	89	6.3
20	0.0883	168	85	9.5
30	0.0425	136	89	6.4
40	0.0261	137	88	6.2
50	0.0177	138	88	5.9
60	0.013	157	87	5.7
80	0.009	248	89	13.1
120	0.0066	129	82	7.7
180	0.0046	137	86	8.3

CA02

1	2	3	4	5
0	0.363	114	88	2.6
10	0.271	21	88	3.7
20	0.196	113	88	4.4
30	0.135	122	87	1.3
40	0.0983	128	88	1.7
60	0.0496	133	88	2.6
80	0.0275	144	88	2.8
100	0.0163	166	89	4.3
140	0.0077	177	88	4.4
180	0.0049	140	88	6.3

TM04

1	2	3	4	5
0	0.397	137	88	3.7
10	0.238	172	88	5.3
20	0.104	221	89	10.6

DE17

1	2	3	4	5
0	0.0551	173	87	2.6
10	0.0269	206	89	1.8
20	0.0101	190	87	4.5
30	0.0061	226	87	5.9
40	0.0045	218	83	9.5
60	0.0031	241	84	8.7
80	0.0024	228	82	6.2
100	0.002	245	84	8.9
140	0.0016	264	85	2.9
180	0.0013	260	85	2.6

SY18

1	2	3	4	5
0	0.28	22	84	6.3
10	0.104	7	88	4.5
20	0.0345	3	88	4.6
30	0.0212	313	89	4.9
40	0.0169	337	89	5.5
60	0.0133	80	89	6.2
100	0.0099	20	87	6.6
140	0.0092	38	89	6
180	0.0083	56	87	9.1

KE02

1	2	3	4	5
0	0.316	305	88	2.3
10	0.199	29	88	1.6
20	0.088	34	88	1.8
30	0.0499	33	88	2.9
40	0.0328	19	87	3.4
60	0.0176	357	87	4.1
100	0.0088	351	85	5.3
140	0.0071	13	84	4.3
180	0.0057	16	85	7.7

MT02

1	2	3	4	5
0	0.0791	201	88	1.8
10	0.0439	225	87	1.8
20	0.0221	184	88	3.9
30	0.0141	342	89	3
40	0.0112	9	87	5.5

30	0.056	225	89	6.4
40	0.04	249	89	6.8
60	0.0279	243	89	9.4
100	0.0193	294	87	6.5
140	0.016	354	79	16
180	0.0135	288	88	7.9

60	0.0079	58	90	8.5
80	0.0057	292	89	5.5
100	0.0049	102	88	6.9
140	0.0042	25	89	5
180	0.0039	86	89	4.4

PP01C1

1	**2**	**3**	**4**	**5**
0	0.578	52	89	5.2
10	0.381	357	90	4.5
20	0.221	246	90	5.3
30	0.162	193	90	5.8
40	0.144	181	89	4.5
60	0.0868	194	89	2.4
100	0.0593	193	88	2.8
140	0.0489	188	87	3.5
180	0.0438	199	87	3

VE04A2

1	**2**	**3**	**4**	**5**
0	0.204	351	90	5.1
10	0.114	275	88	5.1
20	0.0406	284	89	4.1
30	0.024	315	89	3.8
40	0.0187	257	89	3.2
50	0.0164	337	89	3.5
60	0.0151	340	89	3.5
80	0.0145	23	89	5.6
120	0.0132	36	89	4.4
180	0.0123	17	89	4

Experiment 6 (p96)

AG19A

1	2	3	4	5
0	0.364	176	89	5.9
200	0.185	178	87	6.9
300	0.135	327	89	6.1
400	0.075	151	87	9
460	0.04	133	87	4
510	0.021	180	88	2.8
560	0.007	163	88	1.5
610	0.002	170	87	5.3

DE17

1	2	3	4	5
0	0.056	195	88	2.3
200	0.036	235	89	2.8
300	0.03	204	88	1.8
400	0.016	281	89	2
460	0.012	204	87	2.1
510	0.009	173	88	2.2
560	0.004	171	87	1.8
610	0.001	186	89	1.6

GO04

1	2	3	4	5
0	0.545	133	88	3.6
200	0.249	120	87	6.5
300	0.135	115	87	10.3
400	0.062	157	89	8.7
460	0.027	163	84	7.7
510	0.012	191	86	12.5
560	0.002	169	77	8.7
610	0	128	18	23.6

CA02

1	2	3	4	5
0	0.353	92	87	1.7
200	0.222	89	85	4.8
300	0.174	90	85	3.1
400	0.123	132	85	5
460	0.085	[illegible]3	85	1.5
510	0.046	85	87	1.3
560	0.005	117	87	1.9
610	0.001	149	84	9.9

VE04A2

1	2	3	4	5
0	0.195	239	86	1.2
200	0.0973	237	88	6.5
300	0.0434	242	87	2.1
400	0.0218	211	87	3.5
460	0.0064	145	85	1.9
510	0.0016	169	62	4.3
560	0.0006	144	60	6.9
610	0.0003	146	62	2.9

Experiment 7 (p97 - 100)

AG17

1	2	3	4	5
0	0.145	8	57	7.3
100	0.141	9	57	6.9
200	0.138	8	58	9.6
300	0.133	11	58	8.5
350	0.101	13	58	8.8
400	0.086	7	57	8.1
469	0.0577	6	57	7.6
523	0.0318	9	56	9.4
572	0.0126	358	54	18.2
609	0.00385	11	53	8.5

DE28

1	2	3	4	5
0	0.00013	260	-20	3.9
100	0.00013	257	-20	3.5
200	0.00013	260	-22	3.6
300	0.0001	260	-23	9.9
350	9.1E-05	259	-25	5.5
400	6E-05	257	-29	4.9
469	1E-05	248	-32	14.8
523	3.4E-06	260	-11	39.7
572	2.4E-06	267	-2	41.2
609	2E-07	275	-18	57.5

CO01

1	2	3	4	5
0	0.028	249	35	15.3
100	0.0271	254	35	14.5
200	0.0226	252	35	17.2
300	0.0167	255	34	16.8
350	0.0137	255	38	16.3
400	0.0104	253	33	19.1
469	0.00535	254	35	16.7
523	0.00219	254	36	22.5
572	0.00057	249	50	19.8
609	0.00024	193	24	17.6

GO09

1	2	3	4	5
0	0.14	274	43	6.6
100	0.126	273	42	3.6
200	0.105	272	43	5.8
300	0.079	277	43	6
350	0.0542	272	42	6
400	0.0305	276	48	3.9
469	0.00632	287	55	5
523	0.00032	263	26	6.1
572	0.00252	298	12	10.9
609	0.00205	32	-3	4.6

PK09

1	2	3	4	5
0	0.105	102	60	6.5
100	0.102	102	61	6.6
200	0.0942	101	60	6.9
300	0.0796	104	60	7.5
350	0.0702	100	58	8
400	0.0524	104	57	11
458	0.0269	101	55	16.5
510	0.018	100	55	22.1
568	0.00169	44	65	19.1
609	0.00062	354	19	26.8

KC01B

1	2	3	4	5
0	0.0665	67	45	2.6
100	0.0634	65	45	2.8
200	0.0519	62	45	5.5
300	0.0343	64	46	3.5
350	0.0258	64	46	4.9
400	0.0174	66	48	8.4
458	0.0089	63	44	10
510	0.00281	70	46	8.5
568	0.00087	23	31	8.8
609	0.00032	342	27	21.5

KN12

1	2	3	4	5
0	6.6E-05	293	52	7.1
100	6.1E-05	288	51	7.1
200	4.7E-05	292	53	10.5

AP08B1

1	2	3	4	5
0	0.0116	339	-64	5.6
100	0.00961	345	-63	7.4
200	0.0069	338	-63	2.9

300	3.3E-05	290	55	19.5
350	1.2E-05	294	49	24.2
400	6.2E-06	314	53	32.8
458	3.2E-06	301	42	65.2
510	1.2E-06	349	80	90

BI02

1	2	3	4	5
0	0.0828	236	55	13.6
100	0.0817	237	56	14
200	0.0806	232	54	13.4
300	0.0402	232	54	14.8
350	0.0333	237	57	15.5
400	0.0242	230	58	15.5
458	0.00803	231	55	17.9
510	0.00107	146	86	16.6
568	0.0005	338	36	18.6
609	0.00035	327	17	26.6

CA06

1	2	3	4	5
0	0.0175	288	-16	3.8
100	0.0171	283	-18	5.9
200	0.0154	292	-16	6.8
300	0.0151	292	-16	3.2
350	0.0143	287	-15	2.3
400	0.013	290	-17	4.8
469	0.0117	291	-13	8.3
523	0.00821	293	-16	10
572	0.00132	289	-12	7
609	0.00007	68	16	25.1

TM16

1	2	3	4	5
0	0.0284	25	56	10.8
100	0.0271	26	57	12
200	0.0232	26	57	15.6
300	0.0186	21	56	13.6
350	0.0142	26	52	18.8
400	0.01	32	51	22.3
458	0.00337	29	55	12
510	0.00179	28	55	14.6
568	0.00032	1	45	9.7
609	0.00012	33	37	13.6

RU12A

300	0.0018	341	-47	9.3
350	0.00094	342	-60	10.1
400	0.00062	374	-42	9.1
458	0.0004	356	-54	8.7
510	0.00024	356	-58	18.7
568	0.0001	348	-45	12
609	0.00009	351	-51	24.2

CN06

1	2	3	4	5
0	0.0512	260	31	4.9
100	0.0498	261	32	5.8
200	0.0426	261	31	4.3
300	0.0314	256	32	4.3
350	0.0261	261	32	7.8
400	0.0174	258	34	8.9
458	0.00808	258	32	8.1
510	0.00283	259	32	3.6
568	0.00097	267	31	13.8
609	0.00078	263	29	21.6

KEA

1	2	3	4	5
0	0.0824	351	46	3.7
100	0.0807	354	45	2.3
200	0.0761	356	45	2.7
300	0.0668	351	45	5.5
350	0.0613	352	43	4.4
400	0.0467	351	45	3.3
458	0.0252	345	43	3.2
510	0.00595	346	46	4.5
568	0.00065	345	22	8.9
609	0.00025	1	15	18.3

MT18

1	2	3	4	5
0	0.0103	294	10	15.9
100	0.00876	298	11	15.6
200	0.00812	298	12	13.9
300	0.00715	298	10	23.1
350	0.00603	301	13	16.3
400	0.00424	304	13	23.7
458	0.00288	310	12	26.6
510	0.00173	303	11	26.1
568	0.00027	312	11	16.9
609	0.00004	47	9	32.6

1	2	3	4	5
0	0.00023	328	62	19
100	0.0002	333	62	17.6
200	0.00016	353	56	18.7
300	4.6E-05	354	65	21.1
350	3E-05	270	65	29.9
400	2.6E-05	2	30	19.8
458	1E-05	34	14	32
510	1E-05	63	12	23.6
568	1.1E-05	350	2	16.4
609	1.1E-05	10	-7	18.9

ST09

1	2	3	4	5
0	0.0182	273	25	2.7
100	0.0182	273	23	5
200	0.017	271	22	4.5
300	0.0136	276	21	8.1
350	0.0126	267	23	8.6
400	0.0108	271	19	6.3
469	0.0075	274	22	3.4
523	0.00375	273	21	8.8
572	0.00048	291	24	5.8
609	0.00017	149	17	12.6

ST15

1	2	3	4	5
0	0.00587	197	-73	5.8
100	0.00576	202	-72	6
200	0.00536	201	-74	5.6
300	0.00402	193	-84	4.7
350	0.00316	200	-78	7.2
400	0.00234	171	-80	10.3
469	0.00085	126	-23	31.3
523	0.00082	88	45	15.8
572	0.00013	35	30	22.9
609	9.7E-05	335	-8	22.3

ST11

1	2	3	4	5
0	0.00028	196	21	9.6
100	0.00024	193	24	13.5
200	0.00026	191	23	10.2
300	0.00023	191	11	12.6
350	0.0002	183	14	6.9
400	0.00013	189	14	5.3

VE05A2

1	2	3	4	5
0	0.0201	208	-64	3.9
100	0.0186	216	-62	5.6
200	0.0137	213	-63	5.5
300	0.00884	225	-61	7.9
350	0.00586	211	-59	4.6
400	0.00342	209	-66	6.6
469	0.00188	205	-66	7.1
523	0.0001	181	-77	9.5
572	0.0001	348	-45	12
609	0.00008	243	-60	4.9

ST16

1	2	3	4	5
0	0.0644	283	-18	4.5
100	0.0636	282	-17	3.7
200	0.0583	283	-18	3.8
300	0.0474	284	-17	3.6
350	0.0401	281	-17	3.5
400	0.0324	286	-16	3.8
469	0.0167	282	-23	11.1
523	0.00238	280	-14	6.2
572	0.00025	306	-4	14.5
609	0.00011	19	-5[illegible]	46.3

ST05

1	2	3	4	5
0	0.0282	310	-6	7
100	0.0282	306	-4	7.5
200	0.0273	308	-6	6
300	0.0252	307	-6	6.6
350	0.0238	304	-7	6.5
400	0.0209	301	-5	5.9
469	0.0144	297	-4	5.8
523	0.00415	303	-2	4.8
572	0.00033	316	-3	5.8
609	0.00008	152	5	17.8

ST24

1	2	3	4	5
0	0.00734	106	70	2.7
100	0.00763	105	71	1.8
200	0.00757	103	71	2.1
300	0.00681	92	77	2.8

469	4.6E-05	175	17	6.5
523	1.2E-05	171	22	33.2
572	2.3E-06	214	56	90

350	0.00595	109	73	1.5
400	0.00465	93	72	4.8
469	0.00409	102	70	3.1
523	0.00262	88	75	9.2
572	0.0008	90	72	3
609	0.00022	4	34	18.2

APPENDIX B

This Appendix indicates the experiments carried out on each individual sample.

1 = Alternating field demagnetisation of natural remanent magnetisation;

2 = Alternating field demagnetisation of anhysteretic remanent magnetisation;

3 = Isothermal remanent magnetisation acquisition;

4 = Back field;

5 = Alternating field demagnetisation of isothermal remanent magnetisation;

6 = Thermal demagnetisation of isothermal remanent magnetisation;

7 = Thermal demagnetisation of natural remanent magnetisation.

	1	2	3	4	5	6	7
AG19A	•	•	•	•	•	•	
AG17			•				•
AP-08A	•			•			
AP06B1							•
AV03	•	•					
AV-07	•		•				
BA19	•		•	•			
BA20	•		•	•			
BI-07				•			
BI02			•				•
CA-02	•	•		•	•	•	
CA06			•				•
CN-09	•			•			
CN06			•				•
CO-04B	•			•			
CO01			•				•
CR-08	•		•	•			
CT35	•		•	•			
DE-17	•	•		•	•	•	
DE28			•				•
GO-04		•		•	•	•	
GO09			•				•
GR-02	•			•			
GR-04		•	•				
IN-05	•			•			
IN-08	•	•	•				
KC-12	•			•			
KC01B			•				•
KE-02	•	•		•	•		
KEA			•				•
KN05				•			
KN12							•
MO-02	•						
MO-05	•	•	•				
MT-02	•	•		•	•		
MT18							•
PE-2	•		•				
PK-06	•			•			

PK09							•
PP-01C1		•	•		•		
RU-10B				•			
RU12A			•				•
SA17	•		•	•			
SA18	•		•	•			
SE-04	•		•	•			
ST-11	•	•	•	•			
ST-15	•	•	•	•			
ST-16	•	•	•	•			
ST-24	•	•	•	•			
ST-5	•	•	•	•			
ST-9	•	•		•			
ST05-1							•
ST09-1							•
ST11-1							•
ST15-1							•
ST16-1							•
ST24-1			•				•
SY-18	•	•		•	•		
TH-04	•						
TH-05	•		•				
TI08	•		•	•			
TI16	•		•	•			
TM-04	•	•		•	•		
TM16			•				•
TS04	•		•	•			
TS05	•		•	•			
VE-04A2	•	•		•	•	•	
VE05A2							•