Gloucestershire Minerals Plan
Cotswold Sites

Agricultural Land Classification

August 1997

Resource Planning Team
Bristol
FRCA Western Region

Job Number 52 54/97

MAFF Reference EL 14/976

GLOUCESTERSHIRE MINERALS PLAN

COTSWOLD SITES

AGRICULTURAL LAND CLASSIFICATION SURVEY

CONTENTS

GLOUCESTERSHIRE MINERALS PLAN

COTSWOLD SITES

AGRICULTURAL LAND CLASSIFICATION SURVEY

INTRODUCTION

1 This report presents the findings of a detailed Agricultural Land Classification (ALC) survey of 154 ha of land in 3 sites in the Cotswolds area of Gloucestershire Field survey was based on 158 auger borings and 15 soil profile pits and was completed in August 1997 During the survey 14 samples were analysed for particle size distribution (PSD)

2 The survey was conducted by the Resource Planning Team of FRCA Western Region on behalf of MAFF in its statutory role in the preparation of Gloucestershire Minerals Plan

3 Information on climate geology and soils and from previous ALC surveys was considered and is presented in the relevant section The current survey uses the Revised Guidelines and Criteria for grading the quality of agricultural land (MAFF 1988) and supersedes any previous ALC survey Grade descriptions are summarised in Appendix I

SUMMARY

4 The distribution of ALC grades is shown on the accompanying 1 10 000 scale ALC maps The detail of information shown at this scale is appropriate to the intensity of field survey but could be misleading if enlarged or applied to small areas Areas are summarised in the tables below

Table 1 Distribution of ALC grades Daglingworth Quarry

Grade	Area (ha)	% Surveyed Area (17 5ha)
3b	17 5	100
Other land	2 4	
Total site area	19 9	

5 This shows that none of the area surveyed was found to be best and most versatile All the area is shown as Subgrade 3b with moderate limitations of droughtiness restricted workability and topsoil stone content

Table 2 Distribution of ALC grades Huntsman s Quarry

Grade	Area (ha)	% Surveyed Area (125 8 ha)
2	12 1	10
3a	11 2	9
3b	77 9	62
5	24 6	19
Other land	1 0	0
Total site area	126 8	100

6 This shows that 19% of the area surveyed was found to be best and most versatile Areas of Grade 2 in the east of the site have minor limitations due to droughtiness and restricted workability while Subgrade 3a in the west shows further restricted workability due to heavier topsoil textures However the majority of the site is shown as Subgrade 3b limited by droughtiness and topsoil stoniness Areas of unrestored surface quarrying in the east of the site are shown as Grade 5 due to topsoil stoniness and microrelief limitations

Table 3 Distribution of ALC grades Guiting Quarry

Grade	Area (ha)	% Surveyed Area (7 3 ha)
3b	7 3	100
Total site area	7 3	

7 This shows that none of the land surveyed was found to best and most versatile The whole site is shown as Subgrade 3b with moderate limitations ranging from restricted workability and topsoil stone content to wetness where a slowly permeable layer is found in the subsoil

CLIMATE

8 Estimates of climatic variables for these sites were derived from the published agricultural climate dataset Climatological Data for Agricultural Land Classification (Meteorological Office 1989) using standard interpolation procedures Data for key points around the sites are given in the relevant section

9 Since the ALC grade of land is determined by the most limiting factor present overall climate is considered first because it can have an overriding influence by restricting land to a lower grade despite more favourable site and soil conditions Parameters used for assessing overall climate are accumulated temperature a measure of relative warmth and average annual rainfall a measure of overall wetness The results shown at Tables 4 to 6 indicate that there is an overall climatic limitation which limits the land to Grade 2 and even Subgrade 3a at the Guiting Quarry site

10 Climatic variables also affect ALC grade through interactions with soil conditions The most important interactive variables are Field Capacity Days (FCD) which are used in assessing soil wetness and potential Moisture Deficits calculated for wheat and potatoes which are compared with the moisture available in each profile in assessing soil droughtiness limitations These are described in later sections

DAGLINGWORTH QUARRY SITE

11 Apart from the published regional ALC map (MAFF 1977) which shows the sites at a reconnaissance scale as Grade 3 the site had not been surveyed previously Although there may have been no recent detailed ALC survey which is adjacent or nearby other surveys in recent years on similar parent material have found results similar to those outlined in this report

Climate

12 The following data is taken to represent the site

Table 4 Climatic Interpolations Daglingworth

Grid Reference		SP 000 065
Altitude (m)		195
Accumulated Temperature (day °C)		1303
Average Annual Rainfall (mm)		871
Overall Climatic Grade		2
Field Capacity Days		197
Moisture deficit (mm)	Wheat	80
	Potatoes	64

Relief

13 Altitude varies little across the site at around 195 m and with gentle and moderate slopes which are not limiting

Geology and Soils

14 The underlying geology of the site is shown on the published geology map (IGS 1946) as Jurassic Great Oolitic Limestone This was entirely borne out by the current survey with limestone and limestone rubble coming close to the surface across the site making most borings impenetrable to the auger below the topsoil Only at one point was there sufficient depth of soil with lower stone content to auger to 100 cm

15 Soils were mapped by the Soil Survey of England and Wales at a reconnaissance scale of 1 250 000 (SSEW 1983) as Sherborne Association described as shallow well drained brashy calcareous clayey soils over limestone associated with slowly permeable calcareous clayey soils The current survey found characteristic shallow profiles with no evidence of the deeper slowly permeable clay soils at this site

Agricultural Land Classification

16 The distribution of ALC grades found by the current survey is shown on the accompanying 1 10 000 scale map and areas are summarised in Table 1 The detail of information shown at this scale is appropriate to the intensity of field survey but could be misleading if enlarged or applied to small areas

Subgrade 3b

17 The area shown as Subgrade 3b was found to have mainly silty clay topsoil texture at Wetness Class I indicating a primary moderate limitation due to topsoil workability Total stone contents were assessed at two pit sites as ranging from 26% in the topsoil to over 80% in the fissured rock lower subsoil Calculations of available water in the profile to 90 or 100 cm indicate a droughtiness limitation also to Subgrade 3b level Sieving of topsoil samples showed larger stones retained on a 2 cm sieve to comprise 18% at one pit and 17% at the other indicating a restriction to Subgrade 3b also on the basis of topsoil stone content

Other Land

18 The off lying site at Hinton s Gorse was observed to be woodland

HUNTSMAN'S QUARRY SITE

19 Apart from the published regional ALC map (MAFF 1977) which shows the site at a reconnaissance scale as Grade 3 the site had not been surveyed previously However a number of surveys had been carried out across adjacent areas (ADAS 1989 1994) and one nearby (ADAS 1994) Attention was paid to these surveys when grading land in the present survey

Climate

20 The following data is taken to represent the site

Table 5 Climatic Interpolations Huntsman s Quarry 1997

Grid Reference		SP 132 259	SP 113 263
Altitude (m)		205	250
Accumulated Temperature (day °C)		1280	1229
Average Annual Rainfall (mm)		786	811
Overall Climatic Grade		2	2
Field Capacity Days		178	183
Moisture deficit (mm)	Wheat	80	75
	Potatoes	63	57

Relief

21 Altitude ranges from 205 metres near Chalkhill Farm to 250 metres in the extreme south west of the site

Geology and Soils

22 The underlying geology of the site is shown on the published geology map (IGS 1978) as Great Oolite Jurassic limestone This was borne out by the recent ALC survey

23 Soils were mapped by the Soil Survey of England and Wales at a reconnaissance scale of 1 250 000 (SSEW 1983) as largely Elmton 1 Association with small areas of Sherborne Association More detailed soils information is also available in the 1 25 000 scale survey of the Stow on the Wold area Soils in Gloucestershire II (SSEW 1978)

24 The Elmton 1 Association is described as having variably shallow well drained brashy calcareous fine loamy soils over limestone The Sherborne Association is developed on Jurassic limestone and thin interbedded clays which gives considerable soil variation although generally the soils are described as shallow well drained brashy calcareous clayey soils over limestone

25 In the recent survey soils were found to have a considerable range of textures from clay to sandy silt loam Although generally shallow over limestone there were also deep well drained loamy soils found in the east of the site

Agricultural Land Classification

26 The distribution of ALC grades found by the current survey is shown on the accompanying 1 10 000 scale map and areas are summarised in Table 2 The detail of information shown at this scale is appropriate to the intensity of field survey but could be misleading if enlarged or applied to small areas

Grade 2

27 Land of very good quality was identified in the east of the site in two areas one south of Keepers Lodge and one east of Huntsman s Quarry and south of the disused quarry near Stonefield The soils were described as having sandy clay loam and clay loam topsoil textures which overlay clay loam and sandy clay loam subsoils A profile pit identified high stone contents at depth and the soils were assessed as slightly droughty The soils were not limited by wetness and were assessed as Wetness Class I although they have a minor workability limitation due to the high number of field capacity days in this area

Subgrade 3a

28 An isolated area of land in the west of the site is shown as Subgrade 3a The soils were found to have moderately stony heavy silty clay loam topsoils overlying very stony to extremely stony and rather heavier subsoils Examination of two soil profile pits determined the soils to be slightly droughty and Wetness Class I but with a workability limitation due to the nature of the topsoil Within this area occasional borings of Grade 2 quality were identified where soils had a lighter topsoil texture and were less stony at depth However these were too isolated to map at this scale

Subgrade 3b

29 Land of moderate quality covers the majority of the surveyed area Although auger borings were generally impenetrable below the topsoil five profile pits allowed examination of subsoil conditions and assessment of stone contents by sieving This found topsoil stone contents retained on a 2 cm sieve ranging from just over 15% to 20% Total subsoil stone contents below around 20 cm varied little at 70% to 90% Typical soils in this mapping unit are therefore limited by topsoil stone content and droughtiness where the available water for the profile was generally calculated to around 100 cm

30 In a small area around Pit 7 and at very occasional scattered borings elsewhere soils were found to be less stony with heavy silty clay loam topsoils over clay subsoil This was found to be a slowly permeable layer and such profiles were assessed as Wetness Class III or IV

Grade 5

31 The areas shown as Grade 5 comprise mainly unrestored surface quarry workings with very severe limitations due to topsoil stone content soil depth and microrelief These conditions are illustrated by Pits 9 and 10 Small areas around the edges of the fields may be less severely limited but are included within the Grade 5 mapping unit Indeed one small area at ASP 102 was found to be undisturbed

Other Land

32 Other land includes farm buildings woodland and an area of non agricultural land within a disused quarry site

GUITING QUARRY SITE

33 Apart from the published regional ALC map (MAFF 1977) which shows the sites at a reconnaissance scale as Grade 3 the site had not been surveyed previously Although there is no recent detailed ALC survey which is adjacent or nearby an undated survey prior to 1989 at the Cotswold Hill Quarry Ford found Subgrades 3b and 3c as defined under the guidelines at that time although these are now superseded

Climate

34 The following data is taken to represent the site

Table 6 Climatic Interpolations Guiting Quarry

Grid Reference		SP 079 310	SP 078 308
Altitude (m)		285	265
Accumulated Temperature (day °C)		1187	1210
Average Annual Rainfall (mm)		800	795
Overall Climatic Grade		3a	2
Field Capacity Days		178	177
Moisture deficit (mm)	Wheat	72	75
	Potatoes	53	56

Relief

35 Altitude ranges from 275 m at the bottom to 285 m at the top of the site with gentle and moderate slopes which are not limiting

Geology and Soils

36 The underlying geology of the site is shown on the published geology map (IGS 1978) as Jurassic Inferior Oolitic Limestone This was borne out by the current survey although the stone content at the surface was found to be variable and the limestone was found to be interbedded with clay at least within the soil profile which has a significant effect on ALC grade

37 Soils were mapped by the Soil Survey of England and Wales at a reconnaissance scale of 1 250 000 (SSEW 1983) as Elmton 1 Association which is described as well drained brashy calcareous fine loamy soils over limestone The current survey found soils matching this description but also soils with a clayey topsoil and others with a slowly permeable clayey subsoil over limestone

Agricultural Land Classification

38 The distribution of ALC grades found by the current survey is shown on the accompanying 1 10 000 scale map and areas are summarised in Table 4 The detail of information shown at this scale is appropriate to the intensity of field survey but could be misleading if enlarged or applied to small areas

Subgrade 3b

39 The whole of the small site is shown as Subgrade 3b although auger borings across the site showed considerable variation Soils around ASP 2 4 6 and 7 are illustrated by Pit 1 and were found to be heavy clay loam or clay topsoil at Wetness Class I Stone contents were assesssed by sieving and were found to range from 28% total stone (2mm to 6cm) in the topsoil to 80% in the upper and lower subsoil Calculation of available water in the profile to 100 cm indicated droughtiness Subgrade 3a if account were taken of the 20% soil matrix below 36 cm This was considered appropriate in view of the fine root exploitation observed to at least 80 cm A similar calculation showed droughtiness Subgrade 3b if stone contents of 80% below 36 cm were assumed to be 99% fissured rock This particular profile was assessed as Subgrade 3b because of a topsoil stone ((2cm 6cm) content of 16% assessed in topsoil to 25 cm On the basis of auger sample point observations other profiles in the area could well be Subgrade 3b also on droughtiness

40 ASPs 3 and 5 were found to have a clay topsoil and a clay slowly permeable layer although the SPL in each case was found not to extend below 50 cm and these borings were therefore assessed as Subgrade 3b on topsoil workability alone However ASP 8 was found to have a slowly permeable layer extending from 25 to 70 cm and was assessed as Wetness Class IV an isolated observation of Grade 4 with clay topsoil and limited by wetness

P Barnett
Resource Planning Team
FRCA Bristol
28 August 1997

REFERENCES

ADAS RESOURCE PLANNING TEAM (19??) Agricultural Land Classification Survey of Cotswold Hill Quarry Ford Scale 1 2500 Reference 16 ADAS Bristol

ADAS RESOURCE PLANNING TEAM (1989) Agricultural Land Classification Survey of Huntsman s Quarry Naunton Scale 1 5000 Reference 22 89 ADAS Bristol

ADAS RESOURCE PLANNING TEAM (1994) Agricultural Land Classification Survey of Huntsman s Quarry Naunton Scale 1 12 500 Reference 39 94 ADAS Bristol

ADAS RESOURCE PLANNING TEAM (1994) Agricultural Land Classification Survey of Brockhill Quarry Naunton Scale 1 10 000 Reference 136 94 ADAS Bristol

ADAS RESOURCE PLANNING TEAM (1990) Agricultural Land Classification Survey of Fox Farm Upper Swell Scale 1 10 000 Reference 27 90 ADAS Bristol

INSTITUTE OF GEOLOGICAL SCIENCES (1946) Sheet 235 Cirencester 1 63 360 series Drift edition IGS London

INSTITUTE OF GEOLOGICAL SCIENCES (1978) Sheet 217 Moreton in Marsh 1 50 000 series Solid and Drift edition IGS London

HODGSON J M (Ed) (1974) Soil Survey Field Handbook Technical Monograph No 5 Soil Survey of England and Wales Harpenden

HODGSON J M (In preparation) Soil Survey Field Handbook Revised edition

MAFF (1977) 1 250 000 series Agricultural Land Classification South West Region MAFF Publications Alnwick

MAFF (1988) Agricultural Land Classification of England and Wales Revised Guidelines and Criteria for grading the quality of agricultural land MAFF Publications Alnwick

METEOROLOGICAL OFFICE (1989) Climatological Data for Agricultural Land Classification Meteorological Office Bracknell

SOIL SURVEY OF ENGLAND AND WALES (1983) Sheet 5 Soils of South West England 1 250 000 scale SSEW Harpenden

SOIL SURVEY OF ENGLAND AND WALES (1984) Soils and Their Use in South West England Bulletin No 14 SSEW Harpenden

SOIL SURVEY OF ENGLAND AND WALES (1978) Soils in Gloucestershire II Sheet SP12 Soil Survey Record No 52 SSEW Harpenden

APPENDIX I

DESCRIPTION OF GRADES AND SUBGRADES

Grade 1 excellent quality agricultural land

Land with no or very minor limitations to agricultural use A very wide range of agricultural and horticultural crops can be grown and commonly include top fruit soft fruit salad crops and winter harvested vegetables Yields are high and less variable than on land of lower quality

Grade 2 very good quality agricultural land

Land with minor limitations which affect crop yield cultivations or harvesting A wide range of agricultural and horticultural crops can usually be grown but on some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops The level of yield is generally high but may be lower or more variable than Grade 1

Grade 3 good to moderate quality agricultural land

Land with moderate limitations which affect the choice of crops timing and type of cultivation harvesting or the level of yield Where more demanding crops are grown yields are generally lower or more variable than on land in Grades 1 and 2

Subgrade 3a good quality agricultural land

Land capable of consistently producing moderate to high yields of a narrow range of arable crops especially cereals or moderate yields of a wide range of crops including cereals grass oilseed rape potatoes sugar beet and the less demanding horticultural crops

Subgrade 3b moderate quality agricultural land

Land capable of producing moderate yields of a narrow range of crops principally cereals and grass or lower yields of a wider range of crops or high yields of grass which can be grazed or harvested over most of the year

Grade 4 poor quality agricultural land

Land with severe limitations which significantly restrict the range of crops and/or level of yields It is mainly suited to grass with occasional arable crops (eg cereals and forage crops) the yields of which are variable In most climates yields of grass may be moderate to high but there may be difficulties in utilisation The grade also includes very droughty arable land

Grade 5 very poor quality agricultural land

Land with very severe limitations which restrict use to permanent pasture or rough grazing except for occasional pioneer forage crops

Source MAFF (1988) Agricultural Land Classification of England and Wales Revised Guidelines and Criteria for Grading the Quality of Agricultural Land MAFF Publications Alnwick

APPENDIX II

DEFINITION OF SOIL WETNESS CLASSES

Soil wetness is classified according to the depth and duration of waterlogging in the soil profile

Wetness Class I

The soil profile is not wet within 70 cm depth for more than 30 days in most years

Wetness Class II

The soil profile is wet within 70 cm depth for 31 90 days in most years or if there is no slowly permeable layer within 80 cm depth it is wet within 70 cm for more than 90 days but not wet within 40 cm depth for more than 30 days in most years

Wetness Class III

The soil profile is wet within 70 cm depth for 91 180 days in most years or if there is no slowly permeable layer within 80 cm depth it is wet within 70 cm for more than 180 days but only wet within 40 cm depth for between 31 and 90 days in most years

Wetness Class IV

The soil profile is wet within 70 cm depth for more than 180 days but not within 40 cm depth for more than 210 days in most years or if there is no slowly permeable layer within 80 cm depth it is wet within 40 cm depth for 91 210 days in most years

Wetness Class V

The soil profile is wet within 40 cm depth for 211 335 days in most years

Wetness Class VI

The soil profile is wet within 40 cm depth for more than 335 days in most years

Notes The number of days specified is not necessarily a continuous period

'In most years is defined as more than 10 out of 20 years

Source Hodgson J M (In preparation) Soil Survey Field Handbook Revised Edition

APPENDIX III

ABBREVIATIONS AND TERMS USED IN SURVEY DATA

Soil pit and auger boring information collected during ALC survey is held on a computer database and is reproduced in this report Terms used and abbreviations are set out below These conform to definitions contained in the Soil Survey Field Handbook (Hodgson 1974)

1 **Terms used on computer database in order of occurrence**

GRID REF National 100 km grid square and 8 figure grid reference

LAND USE At the time of survey

WHT	Wheat	**SBT**	Sugar Beet	**HTH**	Heathland
BAR	Barley	**BRA**	Brassicas	**BOG**	Bog or Marsh
OAT	Oats	**FCD**	Fodder Crops	**DCW**	Deciduous Wood
CER	Cereals	**FRT**	Soft and Top Fruit	**CFW**	Coniferous Woodland
MZE	Maize	**HRT**	Horticultural Crops	**PLO**	Ploughed
OSR	Oilseed Rape	**LEY**	Ley Grass	**FLW**	Fallow (inc Set aside)
POT	Potatoes	**PGR**	Permanent Pasture	**SAS**	Set Aside (where known)
LIN	Linseed	**RGR**	Rough Grazing	**OTH**	Other
BEN	Field Beans	**SCR**	Scrub		

GRDNT Gradient as estimated or measured by hand held optical clinometer

GLEY SPL Depth in centimetres to gleying or slowly permeable layer

AP (WHEAT/POTS) Crop adjusted available water capacity

MB (WHEAT/POTS) Moisture Balance (Crop adjusted AP crop potential MD)

DRT Best grade according to soil droughtiness

If any of the following factors are considered significant Y will be entered in the relevant column

MREL	Microrelief limitation	**FLOOD**	Flood risk	**EROSN**	Soil erosion risk
EXP	Exposure limitation	**FROST**	Frost prone	**DIST**	Disturbed land
CHEM	Chemical limitation				

LIMIT The main limitation to land quality The following abbreviations are used

OC	Overall Climate	**AE**	Aspect	**EX**	Exposure
FR	Frost Risk	**GR**	Gradient	**MR**	Microrelief

FL	Flood Risk	**TX**	Topsoil Texture	**DP**	Soil Depth
CH	Chemical	**WE**	Wetness	**WK**	Workability
DR	Drought	**ER**	Erosion Risk	**WD**	Soil Wetness/Droughtiness
ST	Topsoil Stoniness				

TEXTURE Soil texture classes are denoted by the following abbreviations

S	Sand	**LS**	Loamy Sand	**SL**	Sandy Loam
SZL	Sandy Silt Loam	**CL**	Clay Loam	**ZCL**	Silty Clay Loam
ZL	Silt Loam	**SCL**	Sandy Clay Loam	**C**	Clay
SC	Sandy clay	**ZC**	Silty clay	**OL**	Organic Loam
P	Peat	**SP**	Sandy Peat	**LP**	Loamy Peat
PL	Peaty Loam	**PS**	Peaty Sand	**MZ**	Marine Light Silts

For the sand loamy sand sandy loam and sandy silt loam classes the predominant size of sand fraction will be indicated by the use of the following prefixes

F Fine (more than 66% of the sand less than 0 2mm)
M Medium (less than 66% fine sand and less than 33% coarse sand)
C Coarse (more than 33% of the sand larger than 0 6mm)

The clay loam and silty clay loam classes will be sub divided according to the clay content **M** Medium (< 27% clay) **H** heavy (27 35% clay)

MOTTLE COL Mottle colour using Munsell notation

MOTTLE ABUN Mottle abundance expressed as a percentage of the matrix or surface described

F few <2% **C** common 2 20% **M** many 20 40% **VM** very many 40%+

MOTTLE CONT Mottle contrast

F faint indistinct mottles evident only on close inspection
D distinct mottles are readily seen
P Prominent mottling is conspicuous and one of the outstanding features of the horizon

PED COL Ped face colour using Munsell notation

GLEY If the soil horizon is gleyed a Y will appear in this column If slightly gleyed an S will appear

STONE LITH Stone Lithology One of the following is used

HR	All hard rocks and stones	**SLST**	Soft oolitic or dolimitic limestone

CH	Chalk	**FSST**	Soft fine grained sandstone
ZR	Soft argillaceous or silty rocks	**GH**	Gravel with non porous (hard) stones
MSST	Soft medium grained sandstone	**GS**	Gravel with porous (soft) stones
SI	Soft weathered igneous or metamorphic rock		

Stone contents are given in % by volume for sizes >2cm >6cm and total stone >2mm

STRUCT The degree of development size and shape of soil peds are described using the following notation

Degree of development	**WA**	Weakly developed Adherent	**WK**	Weakly developed
	MD	Moderately developed	**ST**	Strongly developed
Ped size	**F**	Fine	**M**	Medium
	C	Coarse	**VC**	Very coarse
Ped Shape	**S**	Single grain	**M**	Massive
	GR	Granular	**AB**	Angular blocky
	SAB	Sub angular blocky	**PR**	Prismatic
	PL	Platy		

CONSIST Soil consistence is described using the following notation

L	*Loose*	**VF**	Very Friable	**FR**	Friable	**FM**	Firm
VM	Very firm	**EM**	Extremely firm	**EH**	Extremely Hard		

SUBS STR Subsoil structural condition recorded for the purpose of calculating profile droughtiness **G** Good **M** Moderate **P** Poor

POR *Soil porosity If a soil horizon has poor porosity with less than 0 5% biopores* >0 5mm a Y will appear in this column

IMP *If the profile is impenetrable to rooting* a Y *will appear in this column at the* appropriate horizon

SPL Slowly permeable layer If the soil horizon is slowly permeable a Y will appear in this column

CALC If the soil horizon is calcareous with naturally occurring calcium carbonate exceeding 1% a Y will appear this column

2 Additional terms and abbreviations used mainly in soil pit descriptions

STONE ASSESSMENT

VIS	Visual	**S**	Sieve	**D**	Displacement