Technical Paper 14

GUIDELINES FOR THE DESCRIPTION AND CODING OF SOIL DATA

E.J. van Waveren
A.B. Bos

Revised edition
October 1995

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INTERNATIONAL SOIL REFERENCE AND INFORMATION CENTRE

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SITE DESCRIPTION

General information

Ø = zero, write clearly on ISIS coding form

ISIS_ID ISRIC Monolith identification code. This code consists of ISO 3166 country code (see appendix I) + serial number referring to ISRIC's monolith collection. (given by ISIS supervisor) eg. NLØØ1

Country Entry country code according to ISO 3166 (See appendix I: international codes for names of countries)

Date Enter month and year of description . e.g. january 1993: 01 93

Author(s) The name(s) and initial(s) of the author(s) is given. (eg. Oldeman, L.R. or Van Baren, J.H.V.)

Location A description, as precise as possible. It is advisable to mention the administrative units, such as region, province, district, county or locality. Distance and direction of known village or city. The description of the location should be such that readers who are unfamiliar with the area are able to locate the position of the site.
Spelling of geographical names according to the Times Atlas of the world.

Add (photocopy of) detailed topographical map with location marked to set of "paper files".

Latitude Enter N or S / degrees / minutes / seconds.

Longitude Enter E or W / degrees / minutes / seconds.

Altitude In meters above sea level. When below sea level, add - (minus sign)

Parent material/Parent rock

Parent material is defined as the unconsolidated mineral or organic material from which the true soil develops.
Parent rock is defined as the rock mass from which the parent material is derived (PARKER (eds),1984).

There is space available for a sequence of at most two types of parent material/rock. Use the descriptive part if more space is required (REMARKS).

MODE Mode of accumulation or deposition of parent material. (after USDA/SCS,1979):

- **A** alluvium
- **E** eolian mixed/undifferentiated
- **W** loess
- **S** eolian sand
- **H** volcanic ejecta
- **L** lacustrine, inclusive fluvio and glacio lacustrine
- **Y** estuarine sediments
- **M** marine sediments
- **C** colluvium: (Loose, incoherent deposits that are replaced principally by gravity and accumulated at the foot of slopes or cliffs)
- **V** slope wash: (Soil and rock material that has been transported down a slope predominantly by unchanneled running water (sheet erosion))
- **F** fluvio-glacial deposits
- **I** ice-pushed materials
- **G** glacial outwash: (Sand and gravel transported away from a glacier by streams of melting water and either deposited as a floodplain along a pre-existing valley bottom or broadcast over a preexisting plain in a form similar to an alluvial fan)
- **T** glacial till: (Unsorted and unstratified drift consisting of a heterogeneous mixture of clay, sand, gravel and boulders which is deposited by and underneath a glacier. Also known as boulder clay, till, ice-laid drift)
- **D** glacial drift: (All stratified deposits predominantly of glacial origin made in bodies of glacial melting water or in the sea.)
- **O** organic sediments
- **X** residual (in situ weathered) materials
- **U** unconsolidated, unspecified
- **R** solid rock
- **B** man-made

DERIVED FROM Enter parent rock of which the parent material is derived. (based on USDA/SCS,1979).

YØ	mixed lithology and composition		
Y1	noncalcareous or acid rocks	Y2	calcareous rocks
Y3	mixed lithology, unspecified	Y4	igneous/metamorphic/ sedimentary rocks
Y5	igneous/ metamorphic rocks	Y6	igneous/sedimentary rocks
Y7	metamorphic/sedimentary rocks		
WØ	chemically highly weathered materials (reworked materials)	CØ	conglomerate(unspecified)
W1	lateritic material	C1	non calcareous
W2	bauxitic material	C2	calcareous
IØ	igneous rocks (unspecified)	I5	fine, unspecified
I1	coarse , unspecified	I6	fine, basic (e.g. basalt)
I2	coarse , basic	I7	fine, intermediate (e.g. andesite)
I3	coarse , intermediate(e.g. diorite)	I8	fine, acid(e.g. rhyolite)
I4	coarse , acid (e.g. granite)	I9	fine, ultrabasic
MØ	metamorphic rocks (unspecified)	M5	schist/phyllite,unspecified
M1	gneiss, unspecified	M6	schist/phyllite,acidic
M2	gneiss, acidic	M7	schist/phyllite,basic
M3	gneiss, basic	M8	slate
M4	serpentinite	M9	quartzite
BØ	sedimentary rocks, interbedded (unspecified)	B4	limestone/siltstone
B1	limestone/sandstone and shale	B5	sandstone/shale
B2	limestone/sandstone	B6	sandstone/siltstone
B3	limestone/shale	B7	shale/siltstone
AØ	sandstone (unspecified)	A1	noncalcareous,unspecified

A2	arkosic (A sandstone in which much feldspar is present, ranging from products of granular desintegration of granite to partly sorted riverlaid or even marine deposits)	A3	graywacke (An argillaceous sandstone characterized by an abundance of unstable minerals and rock fragments and a fine grained clay matrix binding the larger particles)
A4	calcareous, unspecified		
HØ	shale (unspecified)	TØ	siltstone (unspecified)
H1	noncalcareous	T1	noncalcareous
H2	calcareous	T2	calcareous
LØ	limestone (unspecified)	L4	phosphatic
L1	chalk	L5	arenaceous (sandy)
L2	marble	L6	argillaceous
L3	dolomitic	L7	cherty
SØ	(other) sedimentary rocks (unspecified)	UØ	claystone (unspecified)
S1	marl, unspecified	U1	noncalcareous
S2	glauconite	U2	calcareous
PØ	pyroclasts, consolidated	EØ	pyroclasts,unconsolidated
P1	tuff, (unspecified) (consolidated equivalent of ash)	E1	ash, unspecified (unconsolidated pyroclasts, grainsize < 2mm)
P2	tuff,acidic	E2	ash,acidic
P3	tuff,basic	E3	ash,basic
P4	volcanic breccia, unspecified (Consolidated rock composed predominantly of angular volcanic particles over 2 mm)	E4	lapilli, unspecified (Unconsolidated pyroclasts, grainsize 2 - 64 mm)
P5	volcanic breccia,acidic	E5	lapilli,acidic
P6	volcanic brecccia,basic	E6	lapilli,basic
P7	tuff breccia	E7	volcanic bombs (Unconsolidated pyroclasts, grainsize > 64 mm.
P8	scoria/cinders (Usually of mafic composition, highly inflated juvenile fragments, of volcanic origin having a much higher density than pumice (they readily sink in water))	P9	pumice (white or pale grey to brown highly vesicular volcanic rock, silicic to mafic glass foam which will commonly float on water)

KØ	miscellaneous organic material	K4	wood fragments <1m
K1	mossy material	K5	wood fragments >1 m
K2	herbaceous material	K6	charcoal
K3	woody material		

TEXTURE Enter texture of parent material

SA	sandy	LO	loamy	ST	stony
SC	sandy clay	CL	clayey	MX	mixed
SI	silty	GR	gravelly	OR	organic

WEATHERING General characterization of status of weathering of solid rock:

- **S slight**
- **P partial / moderate**
- **H high**

RESISTANCE Resistance against weathering (solid rock only):

- **V very high**
- **H high**
- **M moderate**
- **L low**

REMARKS PARENT MATERIAL

Additional remarks parent material/rock up to 20 characters. If more space is required use general descriptive part.

DEPTH LITHOLOGICAL BOUNDARY

Enter depth of lithological boundary in cm.

EFFECTIVE SOIL DEPTH Enter effective soil depth in cm. Effective soil depth is the depth to which roots can easily penetrate throughout the year.

Geomorphology

LANDFORM Enter regional landform. If necessary specify in general descriptive part.

Regional landforms (based on McDonald et al.,1984 and FAO, 1986))

MO	**mountain (unspecified)**	**Landform pattern of very high relief (greater than 300 m) with moderate to precipitous slopes and fixed erosional stream channels which are closely to very widely spaced and form a non-directional or diverging integrated tributary network.**
HI	**hill (unspecified)**	**Landform pattern of high relief (90 - 300 m) with gently inclined to precipitous slopes. Fixed, shallow erosional stream channels, closely to very widely spaced, form a non-directional or convergent integrated tributary network.**
HL	**low hill**	**Landform pattern of low relief (30 - 90 m) and gentle to very steep slopes, typically with fixed erosional stream channels, closely to very widely spaced, which form a non-directional or convergent integrated tributary pattern.**
IN	**inselberg**	**A large steep-sided residual hill, knob, or mountain, generally rocky and bare, rising abruptly from an extensive, nearly lowland erosion surface in arid or semiarid regions.**
VA	**valley (unspecified)**	**Areas of elongated shapes with nearly level and slightly concave topography entrenched between mountains.**
BA	**basin (unspecified)**	**Geomorphic surfaces of low relief intensity with characteristically endoreic drainage patterns and in which accumulation processes are dominant.**
IB	**intermontane basin**	
BL	**badlands**	**Extremely rough, high, narrowly and steeply gullied topography in arid or semiarid areas that are horizontally bedded and have dry, loose soil.**
MM	**man-made**	
UP	**plain (unspecified)**	**Geomorphic surfaces of low relief intensity. Overall slopes less than 2 % with a definite direction and difference in elevation not more than 10 m**

PU	plateau	
PE	peneplain	Landsurface of low elevation and slight relief produced in the late stages of denudation of a landmass.
AP	alluvial plain (unspecified)	
AF	floodplain	Characterized by frequently active erosion and aggradation by channelled or overbank stream flow. (frequent = average recurrence interval of 50 years or less)
AS	stagnant alluvial plain	Alluvial plain on which erosion and aggradation by channelled and overbank stream flow is barely active or inactive because of reduced water supply, without apparent incision or channel enlargement that would lower the level of stream action.
AT	alluvial terrace	Former flood plain, erosion and aggradation by channelled and overbank stream flow is barely active or inactive because of deepening or enlargement of the stream channel has lowered the level of flooding
AD	delta	Floodplain projecting into a sea or lake, with slowly migrating deep alluvial channels.
PM	piedmont features (unspecified)	Region at the foot of amountain or mountain range, more usually composed of fan material.
PA	alluvial fans / bajada / sheetflood fans	Level (less than 1 % slope) to very gently inclined complex landform pattern of extremely low relief.
PP	pediment	A piedmont surface formed from a combination of processes which are mainly erosional; the surface is chiefly bare rock but may have a veneer of alluvium or gravel.
PL	pediplain	A rock-cut erosion surface formed by the coalescence of two or more pediments.
CP	coastal plain	
CB	beach ridge	
CF	tidal flat	Level landform pattern with extremely low relief and slowly migrating deep alluvial stream channels.

CT	marine terrace	
LC	(fluvio) lacustrine plain	Level landform pattern with extremely low relief formerly occupied by a lake but now partly or completely dry.
PY	playa	A low, essentially flat part of a basin or other undrained area in an arid region.
GF	fluvioglacial plain	
GK	kame	Hill composed of sorted coarse water-laid glacial drift, largely sand and gravel, built into an impounded water body within stagnant ice or against the margin of an ice sheet.
GT	fluvioglacial terrace	
GO	outwash plain	
GP	glacial plain (till)	[till unstratified glacial drift deposited by ice and consisting of clay, silt, sand, gravel and boulders, intermingk\led in any proportion]
GM	moraine	
SP	sand plain	
DU	dune field	
VU	volcano	
CA	caldera	Rare landform pattern typically of very high relief and steep to precipitous slope, without stream channels or has fixed erosional channels forming a centripetal integrated tributary pattern.
LA	lava plain	Level to undulating landform pattern of very low to extremely low relief typically with widely spaced fixed erosional stream channels that form a non-directional integrated or interrupted tributary pattern.

TOPOGRAPHY Topography of the surrounding country (FAO, 1977):

F	**flat or almost flat**	**slopes < 2 %**
U	**undulating**	**steepest slopes 2 - 8 %**
R	**rolling**	**steepest slopes 8 -16 %**
H	**hilly**	**steepest slopes 16 - 30 %, range of elevation being moderate**
S	**steeply dissected**	**steepest slopes > 30 %, range of elevation being moderate**
M	**mountainous**	**topography has great range of elevation**

PHYSIOGRAPHIC UNIT Describe physiographic unit in the immediate surrounding of of the site. Continue in general descriptive part if more space is required.

POSITION OF SITE Enter physiographic position of the site:

C crest	**L lower slope**	**V open depression**
U upper slope	**S slope (unspecified)**	**D depression (closed)**
M middle slope	**F flat**	

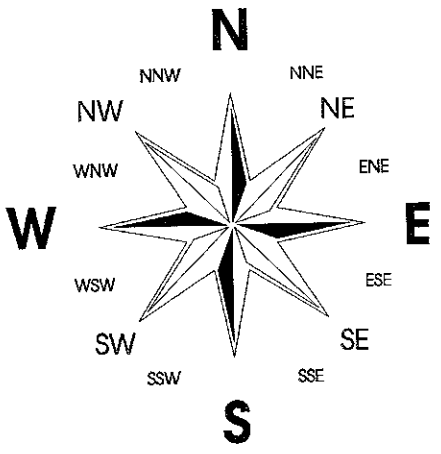
Slope characteristics

SLOPE GRADIENT Enter slope gradient of the land immediately surrounding the site (in %).

SLOPE FORM Form of the slope surrounding the site:

V convex (with a curved surface like the outside of a ball)	**C concave (curved inwards like the inner surface of a ball)**	**U undulating**
S straight	**X complex (irregular)**	

SLOPE ASPECT Aspect (exposure) of site: N,NNE,NE,ENE,E,...,...,NNW.



Microrelief

Small-scale differences in relief within the immediate vicinity (radius of 50 m) of the site. (based upon FAO, 1986)

Microrelief formed by soil erosion is excluded from this item and described under denudational-aggradational processes.

V	level	
D	dimples or cradle - knoll:	depressions and associated mounds left by uprooted trees (dimple = slight hollow in surface, cradle = , knoll = small round hill or mound,
W	coppice mounds:	wind blown material accumulated and stabilized around plants
K	knobs	Low hill of solid rock (characteristic of produced by glaciation
F	frost polygons	Patterned ground formed by freeze-thow(sorting pebbles into polygonal patterns with fine-textured centres
G	gilgai	Typical microrelief of clay soils that have a high coefficient of expansion when the water content changes. It is a succession of closed microbasins and micromounds on a practically horizontal surface or microvalleys and microridges along the slope.
M	mounds (termites)	hillock built up by human or animal activity.
N	animal tracks	
L	levee, artificial:	due to digging and cleaning of drainage and irrigation canals
S	slick spots or scabby spots	
T	terracettes	Small terraces on slopes resulting either from soil creep or trampling by hoofed animals.
R	ripples	Wave-like over sandy or coarse silty materials by wind or waterflow.
H	holes and galleries due to burrowing animals	
A	terracing, artificial	

PATTERN

Ø	none	L	linear	R	reticulate
C	closed depression			I	isolated

HEIGHT Enter variation in height in cm.

Surface characteristics

ROCK OUTCROPS Enter rock outcrop class (FAO, 1977):

Ø	nil, positive statement	
LR	little rocky	less than 2% rock exposed
FR	fairly rocky	exposures roughly 10-35 m apart, coverage 2-10%
RO	rocky	exposures roughly 10-35 m apart, coverage 10-25%
VR	very rocky	exposures roughly 3.5-10 m apart, coverage 25-50%
ER	extremely rocky	exposures up to 3.5 m apart, coverage 50-90%
OU	outcrop	coverage over 90%

STONINESS Enter surface stoniness class (FAO, 1977):

Ø	nil, positive statement	
WS	very few stones	
FS	fairly stony	coverage 0.01 - 0.1 %
ST	stony	coverage 0.1 - 3 %
VS	very stony	coverage 3 - 15 %
ES	exceedingly stony	coverage 15 - 90 %
RU	rubble land	

STONE SIZE Enter average size of stones in cm

S	(sub)rounded	B	angular blocky
A	angular irreglar	P	platy, flat

CRACKING

Ø	nil, positive statement	
C	(small) cracks	width < 1 cm or depth < 50 cm
L	large cracks	width > 1 cm or depth > 50 cm

SLAKING/CRUSTING Slaking of aggregates by tillage, rainfall or frost (USDA/SCS,1979):

Ø	**nil, positive statement**
P	**partly slaked, round smooth aggregates**
S	**slaked: sorted sand/silt, some clay films**
C	**capped, crust on drying**

Enter thickness and nature of crust/seal in profile description.

ALKALI/SALT Evidence of alkali/salt (USDA,1951). The classification given below is used to describe evidence of salt as well as evidence of alkali:

- Ø **soils free of excess alkali or salt. Practically no crops are inhibited by, or show evidence of injury from excess salts or alkali**
- S **soils slightly affected by salt or alkali. The growth of sensitive crops is inhibited but that of salt tolerant crops may not be.**
- M **soils moderately affected by salt or alkali. Crop growth is inhibited and no crop does well**
- R **soils strongly affected by salt or alkali. Only a few kinds of plants survive**

If conductivity measurements and/or analytical data are available the following classes can be recognized:

	class	alkali (ESP	salt (mS/cm
Ø	nil	0 - 5	0 - 4
S	slight	5 - 15	4 - 8
M	moderate	15 - 25	8 - 15
R	strong	> 25	> 15

Hydrology

KIND Indicate kind of water table (USDA,1979):

N	**no water table observed**	**W**	**groundwater table**
F	**flooded**	**A**	**apparent**
P	**perched:**	**The water table of a saturated layer of soil which is separated from an underlying saturated layer by an unsaturated layer (vadose water)**	

DEPTH Enter depth of water table in cm below surface.

FLUCTUATION Enter (estimated values of) upper and lower limits of the water table in cm

SLOW PERMEABLE LAYER Enter upper and lower limits of slow permeable or stagnating layer in cm. Enter **N** if no slow permeable layer is observed.

PERMEABILITY Estimated permeability of least permeable part of the profile:

S	**slow**
M	**moderate**
H	**high**

Quantitative data are recorded in general descriptive part

FLOODING FREQUENCY Indicate flooding frequency, if necessary specify in general descriptive part (FAO, 1986):

N	**nil, positive statement**	**Y**	**yearly**
D	**daily**	**I**	**irregular**
M	**monthly**		

NATURE Nature of flood water:

S	**saline**	**X**	**oxiginated**
B	**brackish**	**W**	**still or stagnant**
F	**fresh**		

Enter additional information (e.g. time and duration of flooding in general descriptive part)

RUN OFF Estimated run off:

P	**ponded**	**M**	**medium**
V	**very slow**	**R**	**rapid**
S	**slow**	**A**	**very rapid**

DRAINAGE CLASS (FAO, 1977), intergrades are indicated by a combination of both class codes: e.g. 34 = class 3 to 4.

Ø	**very poorly drained; water is removed from the soil so slowly that the water table remains at or on the surface the greater part of the time. Soils of this drainage class usually occupy level or depressed sites and are frequently ponded.**
1	**poorly drained; water is removed so slowly that the soil remains wet for a large part of the time. The water table is commonly at or near the surface during a considerable part of the year. Poorly drained conditions are due to a high water table, to a slowly permeable layer within the profile, to seepage, or to a combination of these conditions**
2	**imperfectly drained; water is removed from the soil slowly enough to keep it wet for significant periods but not all of the time. Imperfectly drained soils commonly have a slowly permeable layer within the profile, a high water table, additions through seepage or a combination of these conditions**
3	**moderately well drained; water is removed from the soil somewhat slowly, so that the profile is wet for a small but significant part of the time. Moderately well drained soils commonly have a slowly permeable layer within or immediately below the solum, a relatively high water table, additions of water through seepage or some combination of these conditions**
4	**well drained; water is removed from the soil readily but not rapidly. Well drained soils commonly retain optimum amounts of moisture for plant growth after rains or additions of irrigation water**
5	**somewhat excessively drained; water is removed from the soil rapidly. Many of these soils have little horizon differentiation and are sandy and very porous**
6	**excessively drained; water is removed from the soil very rapidly. Excessively drained soils are commonly lithosols or lithosolic and may be steep, very porous or both**

Moisture conditions profile:

DRY Profile dry from .. to ... (cm)

MOIST Profile moist from ... to ....(cm)

WET Profile wet from .... to..... (cm)

Denudation and aggradation (based upon FAO, 1986)

Indicate nature and intensity of processes at the site and its surroundings (the physiographic unit). If there are any discrepancies between the site and the land surrounding the site, the site data should be entered here. All other information should be entered in the general descriptive part.(based upon FAO, 1986)

EROSION DEGREE Enter intensity of each type of soil erosion. Here the intensity is only described in general terms. If more accurate data are available it should be entered in the general descriptive part.

0	**no erosion**	**M**	**moderate erosion**
S	**slight erosion**	**R**	**severe erosion**

EROSION TYPE Enter soil erosion type. There is space available for 2 types:

S	**sheet erosion**
R	**rill erosion: depth < 30 cm; completely smoothed by normal cultivation**
G	**gully erosion: depth > 30 cm; not smoothed by normal cultivation**
W	**wind erosion**

SOIL AGGRADATION Indicate occurrence of recent soil aggradation (McDONALD et al.,1984):

Ø	**nil, positive statement**
N	**not apparent**
P	**present, specify in General remarks**

SLOPE STABILITY Indicate present stability of slope:

N	**stable**	**no evidence of recent mass movements**
M	**locally unstable**	**creep, locally shallow earth/soil slides,flows**
H	**highly unstable**	**major part of slope is affected by shallow and deep slides /flows etc.**

Land use and Vegetation

Describe present land use or vegetation at the **immediate surroundings of the site.** Use REMARKS for additional information on present land use/vegetation. Use the general descriptive part to add information on past land use/vegetation, or to describe deviating land use/vegetation types close to the site in the same physiographic unit.

LAND UTILIZATION TYPE Indicate present land use type (LUT) . Use REMARKS to specify:

A	**arable farming: unspecified**
AH	**arable farming: high level: intensive use of fertilizers and pesticides, high level of mechanization**
AM	**arable farming: medium level**
AL	**arable farming: low level: low inputs,low level of mechanization**
X	**mixed farming : unspecified**
XH	**mixed farming : high level**
XM	**mixed farming : medium level**
XL	**mixed farming : low level**
PA	**cultivated pasture**
GR	**(semi) natural grass land, grazed**
SH	**shrub land, grazed**
WO	**wood land, grazed**
UR	**urban land**
NA	**non agricultural land: surface mines, pit spoils etc.**
AF	**afforestation**
VE	**(semi) natural vegetation**
FA	**fallow**

CROPS Indicate present or major crop. Use REMARKS to specify or enter additional crops:

CEREALS	**CE**	**unspecified**	**CES**	**sorghum**
	CER	**rice**	**CET**	**millet**
	CEW	**wheat**	**CEX**	**other**
	CEM	**maize**		
ROOT CROPS	**RT**	**unspecified**	**RTY**	**yam**
	RTC	**cassava**	**RTT**	**taro**
	RTP	**potatoes**	**RTX**	**other**
SUGAR CROPS	**SUC**	**sugar cane**		
	SUB	**sugar beet**		
VEGETABLES	**VE**	**unspecified**		
FODDER CROPS	**FD**	**unspecified**		
CONDIMENTS	**CN**	**unspecified**		
OIL/PROTEIN CROPS	**OL**	**unspecified**	**OLB**	**castor bean**
	OLY	**soya bean**	**OLH**	**chick pea**
	OLG	**ground nut**	**OLU**	**sunflower**
	OLA	**safflower**	**OLE**	**sesame**
	OLC	**coconut**	**OLO**	**olive**
	OLI	**oil palm**	**OLX**	**other**
FIBRE CROPS	**FB**	**unspecified**	**FBJ**	**jute**
	FBC	**cotton**	**FBR**	**rosella**
	FBK	**kenaf**	**FBX**	**other**
	FBS	**sisal**		
FRUIT CROPS	**FR**	**unspecified**	**FRC**	**citrus**
	FRB	**banana**	**FRG**	**grapes**
	FRD	**date palm**	**FRX**	**other**
STIMULANTS	**ST**	**unspecified**	**STC**	**coffee**
	STT	**tea**	**STB**	**tobacco**
	STA	**cocoa**	**STX**	**other**
MISCELLANEOUS	**MSP**	**pyrethrum**		
	MSR	**rubber**		
	MAN	**annual crops, unspecified**		
	MPE	**perennial crops, unspecified**		
	MXX	**other**		

IRRIGATION Enter main type of irrigation (FAO, 1986):

- **Ø** no irrigation, not relevant
- **S** seasonally irrigated, supplementary irrigation
- **C** continuously irrigated
- **P** paddy

ROTATION Enter rotation scheme, specify in REMARKS (FAO, 1986):

Ø	not relevant
SS	shifting
SB	shifting - long fallow bush
SG	shifting - long fallow grass
CF	crop rotation with current fallow
CC	crop rotation
CG	crop-grass rotation
MO	mono culture

IMPROVEMENTS Indicate any other land improvements, specify in REMARKS (FAO, 1986):

Ø	none	IL	levelling
IC	land clearing	IT	terracing
ID	draining	IX	other

VEGETATION TYPE Enter major vegetation type (FAO, 1986):

closed forest	F	unspecified
	FE	evergreen (mainly)
	FS	semi-deciduous
	FD	deciduous
	FX	extremely xeromorphic
woodland (open stands of trees)	W	unspecified
	WE	evergreen
	WS	semi-deciduous
	WD	deciduous
	WX	extremely xeromorphic
shrub	S	unspecified
	SE	evergreen
	SS	semi deciduous
	SD	deciduous
	SX	extremely xeromorphic (sub desert)
dwarf shrub	D	unspecified
	DE	evergreen
	DS	semi deciduous
	DD	deciduous
	DX	extremely xeromorphic (sub desert)
	DT	tundra
herbaceous	H	unspecified
	HT	tall grassland
	HM	medium tall grassland
	HS	short grassland
	HF	forb

VEGETATION STATUS Enter present status of vegetation (FAO, 1986):

P	**primary**
M	**modified: altered as a result of new biotic factors**
C	**cut over primary: some trees have been cut**
S	**secondary**
D	**degraded**

REMARKS ON VEGETATION

Enter additional information on present vegetation (e.g. dominant species) and land use (e.g. additional crops). Up to 40 characters

GENERAL REMARKS ON SITE & PROFILE

Enter additional information on site and profile.
Remarks should start with a short field description consisting of
a) **mandatory phrases:**
> depth

very shallow	<20 cm
shallow	20 - 50 cm
moderately deep	50 - 100 cm
deep	100 - 150 cm
very deep	>150 cm

> drainage according to FAO drainage classes
> colour of subsoil according to Munsell soil colour names
> textural class of subsoil according to FAO textural triangle notation
> parent material
b) **facultative phrases:**
depending on the judgement of the author of the field description a selection of striking features should be given. Some examples:
> strongly deviating topsoil, either colour or texture
> strong mottling
> special structure
> etc.

1-example: moderately deep, imperfectly drained, dark grey loam, derived from alluvium; with a thick dark topsoil and strong mottling in the subsoil.
2-example: very deep, well drained, dark red clay, derived from basalt; massive porous structured throughout.

PHOTOGRAPHS / SLIDES

Enter subject and number of slides/photographs: (conform the codes used in the ISRIC SLIDE database.)

code	description	code	description
AP	**aerial photographs**	**PE**	**people**
BI	**biological activity**	**PR**	**profile**
CR	**crops**	**PD**	**profile details**
DI	**diagrams**	**SU**	**surface characteristics**
ER	**erosion /conservation**	**TA**	**tables/text**
LU	**land use**	**VE**	**vegetation**
LA	**landscape**	**XX**	**other**
MA	**maps**		

PROFILE DESCRIPTION

ISIS_ID ISRIC Monolith identification code. This code consists of ISO 3166 country code (see appendix I) + serial number referring to ISRIC's monolith collection. (given by ISIS supervisor) eg. NLØØ1

HORIZON NUMBER Enter serial number of horizon. Top horizon: serial number 1.0 . Use number 1,2,3,..,9,10 etc. Sub horizon can be entered: 2.1

DESIGNATION Enter horizon designation according to FAO (1977)
Enter AUGER in case the data are obtained by augering.

DEPTH Enter upper and lower limit of horizon in cm.

BOUNDARY Indicate width and topography of boundary with horizon below (FAO, 1977):

	Width		Topography
A	abrupt : < 2cm	S	smooth
C	clear : 2-5 cm	W	wavy: pockets wider than deep
G	gradual: 5-12 cm	I	irregular: pockets deeper than wide
D	diffuse: > 12cm	B	broken: boundary discontinuous wide

COLOUR The colour of the soil matrix material of each horizon is recorded in the moist condition (or both dry and moist condition, if possible) using the notations for hue, value and chroma as given in the Munsell Soil Color Charts (Munsell, 1975). If there is no dominant soil matrix colour, the horizon is described as mottled and two or more colours are given.

TEXTURE Enter estimated (field) texture (FAO, 1977).

		Fraction < 2 mm	
SA	sand	CSA	coarse sand
		MSA	medium sand
		FSA	fine sand
		VSA	very fine sand
LSA	loamy sand	CLSA	coarse loamy sand
		MLSA	medium loamy sand
		FLSA	fine loamy sand
		VLSA	very fine loamy sand
SAL	sandy loam	CSAL	coarse sandy loam
		MSAL	medium sandy loam
		FSAL	fine sandy loam
		VSAL	very fine sandy loam
L	loam	SICL	silty clay loam

SIL	silt loam	SAC	sandy clay
SI	silt	SIC	silty clay
SACL	sandy clay loam	C	clay
CL	clay loam		

Fraction 0.2 - 7.5 cm		Fraction 7.5 - 25 cm		
SG	slightly gravelly	SS	slightly stony	2-15%
GR	gravelly	ST	stony	15-50%
VG	very gravelly	VS	very stony	50-90%
GA	gravel	SO	stones	> 90%

Fraction > 25 cm		
BO	bouldery	2 - 50 %
VB	very bouldery	50 - 90 %
BL	boulders	> 90 %

ORGANIC MATTER

Enter kind and rate of decomposition of organic matter.This item is normally used to describe O and H horizons. (Day(ed),1983; FAO, 1986).

Kind:

L	leaves	S	sphagnum	R	reeds, sedges
N	needles	M	other moss	H	herbaceous fragments
W	wood fragments	C	coprogenous earth	U	unspecified

Decomposition rate:

Ø	nil
S	slight : > 50% fibric or foliated material
M	moderate: 10-50% fibric/foliated material
H	high : < 10% fibric/foliated material

STRUCTURE

When a soil contains aggregates of more than one grade, size, or form the different kinds of aggregates should be described separately. There is space for two types of soil aggregates. Enter largest type first (FAO, 1977).

Grade

Ø	structureless: that condition in which there is no observable aggregation or no definite orderly arrangement of natural lines of weakness. Massive if coherent; single grain if non coherent (see form). If the soil is coherent one of the following codes should be entered:
WC	structureless and weakly coherent
MC	structureless and moderately coherent
SC	structureless and strongly coherent.

WE	weak: that degree of aggradation characterized by poorly formed indistinct peds that are barely observable in place. When disturbed, soil material that has this grade of structure breaks into a mixture of few entire peds, many broken peds, and much unaggregated material. If necessary for comparison, this grade may be subdivided into:
VW	very weak
WM	weak to moderate
MO	moderate: that grade of structure characterized by well formed distinct peds that are moderately durable and evident but not distinct in undisturbed soil. Soil material of this grade, when disturbed, breaks down into a mixture of many distinct entire peds, some broken peds, and little unaggregated material.
ST	strong: that grade of structure characterized by durable peds that are quite evident in undisplaced soil, that adhere weakly to one another, and that withstand displacement and become separated when the soil is disturbed. When removed from the profile, soil material of this grade of structure consists very largely of entire peds and include few broken peds and little or no unaggregated material. If necessary for comparison this grade may be subdivided into:
MS	moderate - strong
VS	very strong

Size

VF	very fine	FM	fine to medium	CO	coarse
FF	very fine to fine	ME	medium	CC	coarse to vety coarse
FI	fine	MC	medium to coarse	VC	very coarse

Form

PL	platy	AW	angular blocky (wedge shaped)	MA	massive
PR	prismatic			PM	porous massive
CL	columnar	GR	granular	SG	single grain
AB	angular blocky	CR	crumb	IR	irregular
SB	subangular blocky			RO	rock structure

CONSISTENCE *Consistence.*(FAO, 1977)

Consistence when dry:

LO	**loose**	**noncoherent**
SO	**soft**	**soil mass is very weakly coherent and friable; breaks to powder or to individual grains under very slight pressure**
SH	**slightly hard**	**weakly resistant to pressure; easily broken between thumb and forefinger**
HA	**hard**	**moderately resistant to pressure; can be broken in the hands without difficulty but is barely breakable between thumb and forefinger**
VH	**very hard**	**very resistant to pressure; can be broken in the hands only with difficulty; not breakable between thumb and forefinger**
EH	**extremely hard**	**extremely resistant to pressure, can not be broken in the hands**

Consistence when moist

LO	**loose**	**noncoherent**
VF	**very friable**	**soil material crushes easily under very gentle pressure, but coheres when pressed together**
FR	**friable**	**soil material crushes easily under gentle to moderate pressure between thumb and forefinger**
FI	**firm**	**soil material crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable**
VI	**very firm**	**soil material crushes under strong pressure, barely crushable between thumb and forefinger**
EF	**extremely firm**	**soil material crushes only under very strong pressure; cannot be crushed between thumb and forefinger**

Consistence when wet

a) *Stickiness*:

NS	**nonsticky**	**after release of pressure, practically no soil material adheres to thumb or finger**
SS	**slightly sticky**	**after pressure, soil material adheres to both finger and thumb but comes off one or the other rather cleanly. It is not appreciably stretched when the digits are separated**

ST	**sticky**	**after pressure, soil material adheres to both thumb and finger and tends to stretch somewhat and pull apart rather than pulling free from either digit**
VS	**very sticky**	**after pressure, soil material adheres strongly to both forefinger and thumb and is decidedly stretched when they are separated**

b) *Plasticity:*

NP	**non plastic**	**no wire is formable**
SP	**slightly plastic**	**wire formable but soil mass easily deformable.**
PL	**plastic**	**wire formable and much pressure required for deformation of the soil mass**
VP	**very plastic**	**wire formable and much pressure required for deformation of the soil mass**

Other (after USDA,1985):

WS	**weakly smeary**	**under moderate strong force between thumb and forefinger the soil changes suddenly to fluid, the fingers skid and the soil smears, little or no free water remains on fingers**
MS	**moderately smeary**	**under moderate force between thumb and forefinger the soil changes suddenly to fluid, the fingers skid and the soil smears, some free water remains on fingers**
SS	**strongly smeary**	**under slight force between thumb and forefinger the soil suddenly changes to fluid, the fingers skid and the soil smears, free water is easily seen on fingers.**
SF	**slightly fluid**	**when a specimen is squeezed in the hand some material tends to flow between the fingers, but after full pressure is applied most of the residue is left in the hand**
VF	**very fluid**	**when a specimen is squeezed in the hand, soil material easily flows between the fingers and after full pressure is applied little or no residue is left in the hand.**

PORES Description of individual pores. There is space for two types of pores. For size and quantity also intergrades may be entered. Intergrades are indicated

with the codes of both classes. Enter the code of the class with the lowest value first:

e.g PORE type 1:

few	**| F |**
few to common	**| F C |**
very fine	**| V |**
fine to medium	**| F M |**

If more space is required use general descriptive part

Quantity:

Ø	**none**	**C**	**common: 50-200/dm3**
F	**few :1-50 /dm3**	**M**	**many : >200/dm3**

Size:

I	**micro : < 0.1 mm**	**C**	**coarse: 5-10 mm**
V	**very fine: 0.1-1 mm**	**A**	**very coarse: >10 mm**
F	**fine:1-2 mm**	**T**	**fine to coarse**
M	**medium : 2-5 mm**	**X**	**micro to very coarse**

Form:

V	**vesicular: approx. spherical or ellipsoidal in shape, not appreciably elongated in any direction.**
I	**interstitial: irregular in shape, with inward curved faces, bounded by angular or curved surfaces or adjacent mineral grains or peds or both.**
T	**tubular: more or less cylindrical**

Orientation (applied to tubular pores)

V	**vertical**	**O**	**oblique**
H	**horizontal**	**R**	**random**

	Continuity		*distribution*
C	**continuous**	**I**	**inped**
D	**discontinuous**	**E**	**exped**
B	**both inped / exped**		

POROSITY *Total porosity* (CANSIS,1982):

H	**highly porous : > 60% by volume**
M	**moderately porous: 40-60%**
S	**slightly porous : < 40%**

ROOTS There is space for two types of roots, if more space is required use descriptive part.

Quantity (CANSIS,1982):

Ø	nil	positive statement	
F	few	very fine/fine roots	1 -10 /dm^3
		medium/coarse roots	1 /dm^3
C	common	very fine/fine roots	10 - 100 /dm^3
		medium roots	1 - 10 /dm3
		coarse roots	1 - 5 /dm3
M	many	very fine/fine roots	>100/dm3
		medium roots	> 10/dm3
		coarse roots	> 5/dm3

Size:

V	very fine	diameter < 1 mm
F	fine	diameter 1 - 2 mm
M	medium	diameter 2 - 5 mm
C	coarse	diameter > 5 mm
X	all	very fine to coarse

Location (USDA,1981):

C	in cracks
M	in mat at top of horizon
P	between peds
S	matted around stones or gravel
T	throughout

$CaCO_3$ The content of calcium carbonate (tested with 10% hydrochloric acid). The reaction to acid can be expected to be more vigorous in sandy material than in fine textured material having the same carbonate content.

Agent:

H	HCl 10 %
U	HCl, unspecified strength

Class:

Ø	non calcareous	no visible reaction
S	slightly calcareous	slight reaction; scarcely visible, but detectable to ear
R	calcareous	strong reaction; bubbles in simple layer
V	strongly calcareous	violent reaction; foamy, bubbles in many layers

Location:

T	throughout	N	on nodules
S	on ped faces	C	in channels and holes
L	locally		

pH Enter field determined pH and indicate the method used in the general descriptive part.

MOTTLES There is space for 2 entries (FAO, 1977):

Abundance

Ø	none, positive statement	C	common: 2-20%
F	few: <2%	M	many : >20%

Size

F	fine: < 5 mm	C	coarse: > 15 mm
M	medium: 5 - 15 mm	H	heterogeneous

Contrast

F	faint	indistinct mottles are evident and recognizable only with close examination. Soil colours in both matrix and mottles have closely related hues and chromas
D	distinct	although not striking the mottles are readily seen. The hue value and chroma of the matrix are easily distinguished from those of the mottles. They may vary as much as one or two hues or several units in chroma or value
P	prominent	the conspicuous mottles are obvious and mottling is one of the outstanding features of the horizon. Hue, chroma and value may be several units apart

Sharpness of boundary:

D	diffuse:	> 2mm
C	clear:	< 2mm
S	sharp	

Enter moist colour of mottles (notation see COLOUR):

CUTANS Cutans/surface features.

Quantity/abundance (FAO, 1977):

Ø	none	
P	patchy	small scattered patches of cutan
B	broken/common	cutans cover largest part of peds
C	continuous/abundant	cutans cover entire peds

Thickness (FAO, 1977):

F	thin (faint)	fine sand grains are readily apparent in the cutan, bridges between cutans are weak, thickness microscopic
M	moderate (distinct)	fine sand grains are enveloped in the cutan and their outlines are indistinct
T	thick (prominent)	surface of the cutan is smooth showing no outlines of fine sand grains, strong bridges between larger grains

Kind:

C	clay	H	humus
F	clay / sesquioxides	M	Mn-hydr. / ox
U	clay / humus	Z	soluble salts
S	sesquioxides	Q	silica
P	slickensides	X	unspecified
R	pressure		

Location:

PE	ped faces (unspecified)	HP	horizontal ped faces
VP	vertical ped faces	ZP	hor. / vert. ped faces
CO	top columns	GR	grains
UP	upper surfaces peds	NO	nodules
BR	bridges between sand grains	BP	bottom plates
LP	lower surfaces peds	RC	root channels / pores
TH	throughout	CR	cracks
RO	rock fragments		

INCLUSIONS Inclusions of pedogenetic origin. There is space for two entries (FAO, 1986).

Quantity:

Ø	none	Q	frequent:	15 - 40 %
V	very few: < 5% by volume	R	very frequent:	40-80 %
F	few: 5-15%	D	dominant:	> 80 %

Type:

U	unspecified		
C	concretions	T	cristals
N	nodules	S	soft segregations
P	pedodes: (= A spheroidal, discrete glaebule with a hollow interior, often with a drusy lining of crystals like that of a geode.)		

Size:

P	powdery		M	medium	2 - 10 mm
S	small	< 2 mm	L	large	> 10 mm

Hardness:

S	soft
H	hard

Shape:

S	spherical	T	thread like
I	irregular	D	dendritic
A	angular	C	cylindrical

Composition:

K	calcareous	F	ferrigenous
C	argilleous	M	manganiferous
G	gypsiferous	Z	saline
Q	siliceous	U	unspecified

ROCK Rock and primary mineral fragments. There is space for two entries.

Quantity:

Ø	none	Q	frequent 15 - 40 % by volume
V	very few < 5 % by volume	R	very frequent 40 - 80 % by volume
F	few 5 - 15 %by volume	D	dominant 80 % by volume

Size:

V	very fine:	< 2 mm	C	coarse	7.5 - 12 cm
F	fine:	0.2 - 1 cm	A	very coarse	12 - 25 cm
M	medium:	1 - 7.5 cm	E	extremely coarse:	> 25 cm

Degree of weathering:

F	fresh
W	(slightly) weathered
S	stronglyweathered

Nature/composition: descriptive up to 15 characters. If more space is required use general descriptive part.

PANS This item includes compact and hardened uncemented as well as indurated horizons. There is space for one entry only. If more space is required use general descriptive part (FAO, 1986)

Kind:

P	plough pan	F	fragipan
K	petrocalcic		
L	iron stone(indurated plinthite)	I	iron pan (other than indurated plinthite)
Y	gypsum pan	D	duripan
X	other, explain in General Remarks	S	salt pan

Cementation:(Day(ed),1983;USDA/SCS,1981;FAO, 1986)

Ø	non cemented	
W	weakly cemented	the wet cemented soil is brittle and hard but can be broken by hands
S	strongly cemented	the wet cemented soil is too hard to be broken by hands, but it is easily broken with a hammer
I	indurated	the wet cemented soil is brittle and so strongly cemented that a sharp blow of a hammer is required to break it

Continuity:

C	continuous
D	discontinuous
B	broken

Structure:

M	massive	P	pisolitic
V	vesicular	N	nodular
L	platy		

BIOLOGICAL ACTIVITY

Biological activity: There is space for two major types. If more space is required use the General Remarks.

Abundance:

Ø	nil	Q	frequent
F	few	R	very frequent

Kind:

M	mounds	S	shells
K	krotovinas	P	coprogenic elements
W	worm channels	R	termite channels
Y	mycelium	A	mammal channels
C	sclerotium	X	channels, unspecified, explain in General Remarks
T	pedotubules (unspecified)		

CLASSIFICATION

FAO/UNESCO (1974)

FAO soil unit Enter soil unit code (see appendix II).

Phase Enter phase:

ST	**stony**	**X**	**fragipan**
PE	**petric**	**MQ**	**duripan**
MK	**petrocalcic**	**Z**	**saline**
LI	**lithic**	**SO**	**sodic**
MY	**petrogypsic**	**CE**	**cerrado**
PH	**phreatic**	**MS**	**petroferric**

SOIL TAXONOMY (USDA/SCS,1975)

Great group Enter great group code (see appendix IV).

Sub group Enter sub group code (see appendix IV).

Other diagnostic criteria according to FAO/UNESCO (1974) and USDA/SCS (1975).

Diagnostic horizons Enter diagnostic horizons. There is space for three entries:

AL	**albic**	**PC**	**petrocalcic**	**AN**	**anthropic**
AG	**agric**	**PG**	**petrogypsic**	**HI**	**histic**
AR	**argillic**	**PL**	**placic**	**MO**	**mollic**
CL	**calcic**	**SA**	**salic**	**OC**	**ochric**
CA	**cambic**	**SO**	**sombric**	**UM**	**umbric**
GY	**gypsic**	**SP**	**spodic**	**PL**	**plaggen**
NA	**natric**	**SU**	**sulfuric**	**DU**	**duripan**
FR	**fragipan**	**OX**	**oxic**		

Diagnostic criteria Enter (other) diagnostic criteria. There is space for two entries:

AT	**abrupt textural change**	**LI**	**lithic contact**
AL	**albic material**	**MO**	**mottles with chroma<2**
AM	**exchange complex dom. by amorphous material**	**NV**	**n - value**
CL	**paralithic contact**	**PF**	**permafrost**
CF	**petroferric contact**	**SQ**	**plinthite**
CO	**COLE**	**SL**	**slickensides**
DU	**durinodes**	**SC**	**smeary consistence**
FA	**ferralic properties**	**K**	**soft powdery lime**
FE	**ferric properties**	**SU**	**sulfidic material**
GL	**gilgai**	**TA**	**takyric**
OR	**high organic matter in B**	**TX**	**thixotropy**
SA	**high salinity**	**IR**	**thin iron pan**
HY	**hydromorphic properties**	**TO**	**tonguing**
IF	**interfingering**	**VE**	**vertic properties**
		WE	**weatherable minerals**

Local classification Local classification or soil name. Descriptive space 80 characters. If more space is required use general description

FAO/UNESCO (1988)

FAO soil unit Enter soil unit code (see appendix III).
Enter soil sub unit code (see appendix III).

Phase Enter phase:

ST	**stony**	**X**	**fragipan**
PE	**petric**	**MQ**	**duripan**
MK	**petrocalcic**	**Z**	**saline**
LI	**lithic**	**SO**	**sodic**
MY	**petrogypsic**	**CE**	**cerrado**
PH	**phreatic**	**MS**	**petroferric**

Enter diagnostic horizons. There is space for three entries:

AL	**albic E**	**GY**	**gypsic**	**PG**	**petrogypsic**
AR	**argic B**	**HI**	**histic H**	**SP**	**spodic B**
CC	**calcic**	**MO**	**mollic A**	**SU**	**sulfuric**
CA	**cambic**	**NA**	**natric B**	**UM**	**umbric A**
FA	**ferralic B**	**OC**	**ochric A**	**DU**	**duripan**
FI	**fimic A**	**PC**	**petrocalcic**		

Enter (other) diagnostic criteria. There is space for two entries:

AT	**abrupt textural change**	**OS**	**organic soil materials**
AD	**andic properties**	**PF**	**permafrost**
CS	**calcereous**	**SQ**	**plinthite**
CC	**calcaric**	**SP**	**salic properties**
CR	**continuous hard rock**	**SL**	**slickensides**
FA	**ferralic properties**	**SC**	**smeary consistence**
FE	**ferric properties**	**SO**	**sodic properties**
FL	**fluvic properties**	**K**	**soft powdery lime**
GE	**geric properties**	**SH**	**strongly humic**
GW	**gleyic properties**	**SF**	**sulfidic materials**
GP	**gypsiferous**	**TO**	**tonguing**
IF	**interfingering**	**VE**	**vertic properties**
NI	**nitic properties**	**WE**	**weatherable minerals**

SOIL TAXONOMY (USDA/SCS,1992)

Great group Enter great group code (see appendix V).

Sub group Enter sub group code (see appendix V).

Texture Enter texture class (see appendix VI).

Mineralogy Enter mineralogy class (see appendix VI).

STR Enter soil temperature regime:

PG	**pergelic**	**HT**	**hyperthermic**
CR	**cryic**	**IF**	**isofrigid**
FR	**frigid**	**IM**	**isomesic**
ME	**mesic**	**IT**	**isothermic**
TH	**thermic**	**IH**	**isohyperthermic**

SMR Enter soil moisture regime:

AQ	**aquic**	**UD**	**udic**
PQ	**peraquic**	**PU**	**perudic**
AR	**aridic**	**US**	**ustic**
TO	**torric**	**XE**	**xeric**

Other diagnostic criteria according to USDA/SCS (1992).

AA	anthraquic conditions	LE	linear extensibility
AB	abrupt textural change	NV	n value
AL	albic materials	PC	paralithic contact
AN	andic soil properties	PE	permafrost
AQ	aquic conditions	PF	petroferric contact
AS	anthric saturation	PL	plinthite
CO	coefficient of linear extensibility	SB	sequum and bisequum
DR	durinodes	SC	soft powdery lime
EN	endosaturation	SF	sulfidic materials
EP	episaturation	SL	slickensides
IF	interfingering of albic materials	SP	spodic materials
LC	lithic contact	WM	weatherable minerals

ANALYTICAL METHODS

Preparation Each sample is air-dried, cleaned, crushed (not ground), passed through 2 mm sieve, homogenized. Moisture content is determined at 105° C.

pH H_2O (1:2.5): 20 g of soil is shaken with 50 ml of deionised water for 2 hours, electrode in upper part of suspension.

pH-KCl likewise but shaken with 1 *M* KCl.

EC (1:2.5): Conductivity of pH-H_2O suspension.

Particle-size distribution Soil is treated with 15% hydrogen peroxide overnight in the cold, then on waterbath at about 80°C. Then boiled on hot plate for 1 hour. Washings until dispersion. Dispersing agent is added (20 ml solution of 4% Na-hexametaphosphate and 1% soda) and suspension shaken overnight. Suspension sieved through 50 μm sieve. Sand fraction remaining on sieve dried and weighed. Clay and silt determined by pipetting from sedimentation cylinder.

Water-dispersable clay Pipetting after shaking 20 g of soil overnight (16 hours) with deionized water.

Exchangeable bases and CEC

Percolation with 1*M* ammonium acetate pH7 using automatic extractor. (If EC>0.5mS pre-leaching with ethanol 80%). Cations are determined in the leachate by AAS.
CEC: saturation with sodium acetate 1*M* pH7; washed with ethanol 80% and then leached with ammonium acetate 1*M* pH7. Na determined by FES.

Exchangeable acidity and Aluminium

The sample is extracted with *1 M* KCl solution and the exchange acidity (H+Al) titrated with NaOH. Al is measured by AAS.

Carbonate Piper's procedure. Sample is treated with dilute acid and the residual acid is titrated.

Organic carbon Walkley-Black procedure. The sample is treated with a mixture of potassium dichromate and sulphuric acid at about 125°C. The residual dichromate is titrated with ferrous sulphate. The result expressed in % carbon (because of incomplete oxidation a correction factor of 1.3 is applied).

Total nitrogen Micro-Kjeldahl. Digested in H_2SO_4 with Se as catalyst. Then ammonia is distilled, trapped in boric acid and titrated with standard acid.

P-Bray 1 Phosphate is extracted with a mixture of 0.025 *M* HCl + 0.03 *M* NH_4F and determined colorimetrically.

P-Olsen Phosphate is extracted with 0.5 *M* $NaHCO_3$ solution pH 8.5 and determined colorimetrically.

P-Retention Blakemore et al. Shaken with (KH_2PO_4 + NaAc) solution, 1000 mg/L P pH 4.6 for 16 hours.
Determination of residual P colorimetrically after centrifuging.

pH-NaF To 1g of soil 50 ml of NaF 1*M* is added and stirred for 1 minute. Reading pH by continuous stirring exactly 2 minutes after adding NaF solution.

Extractable Iron, Aluminium, Manganese and Silicon

All determinations by AAS.

1. "Free" (Fe, Al, Mn): Holmgren Shaken with sodium citrate (17%) + sodium dithionite (1.7%) solution for 16 hours.
2. "Active" (Fe, Al, Si): Shaken with acid ammonium acetate 0.2 *M* pH 3 for 4 hours in the dark.
3. "Organically bound" (Fe, Al): Shaken with sodium pyrophosphate 0.1 *M* for 16 hours.

Clay mineralogy

Clay is separated as indicated for particle-size analysis.
about 10-20 mg of clay is brought on porous ceramic tile by suction and analyzed using a Philips diffractometer.

Soluble salts

Measuring pH, EC, cations and anions in water extracts.
1. 1:5 extract. Shaking 30 g of fine earth + 150 ml of water for 2 hours.
2. saturation extract. Adding to 200-1000 g fine earth just enough water to saturate the sample.
Standing overnight.
After filtration Ca, Mg, Na, K are measured by AAS. Cl with the Chlorocounter and SO_4 turbidimetrically.

Gypsum

To 10 g of fine earth 100 ml of water is added, shaken overnight and centrifuged.
Precipitation by adding acetone. Precipitate redissolved in water and determination of Ca by AAS.

Elemental composition

The fine earth is dried, ignited and fused with lithium tetraborate.
The formed bead is analyzed by X-ray fluorescence spectroscopy.

Moisture retention

Moisture determinations on undisturbed core samples in silt box (pF1.0;1.5;2.0) and kaolinite box (pF2.3;2.7) respectivily and on disturbed samples in high pressure pan (pF3.4;4.2).
Bulk density obtained from dry weight of core sample.

REFERENCE:
ISRIC, Technical Paper no.9 (4th ed., 1993)
Procedures for soil analysis. Edited by L.P. van Reeuwijk.

CLIMATE

KÖPPEN Enter climate classification according to Köppen: (Trewartha, 1968)

Af	**tropical wet climate**
Af	**tropical monsoon climate**
Aw	**tropical "wet-and-dry" climate (savanna)**
BW	**arid (desert) climate**
BS	**semi-arid (steppe) climate**
Cf	**mild temperate rainy climate with no distinct dry season**
Cw	**mild temperate rainy climate with dry winters**
Cs	**mild temperate rainy climate with dry summers**
Df	**cold snow-forest climate with humid winters**
Dw	**cold snow-forest climate with dry winters**
ET	**polar tundra climate**
EF	**polar perpetual frost climate**

Other lower case characters used, with:

A climates

w'	**rainfall maximum in autumn**
w"	**two distinct rainfall maxima**
s	**dry season during high-sun period**
i	**temperature range between warmest and coolest month < 5°C**

B climates

h	**hot climate**
k	**cool climate**
k'	**cold climate**
s	**dry summers**
w	**dry winters**
n	**frequent fog**

C climates

a	**hot summers**
b	**cool summers**
i	**temperature range between warmest and coolest month < 5°C**
x	**rainfall maximum late spring; drier in late summer**
n	**frequent fog**

D climates

d	**extremely cold winter month**

f, s, w, a, b, c: see C climate

Entry of climatic data: on the description form is space for data of climatic variables recorded on one single climate station. The ISIS database itself has no limitations in number of stations or number of variables per station.

STATION ISRIC Climatic Station identification code. This code consists of ISO 3166 country code (see appendix I) + C (for climate) + serial number (given by ISIS supervisor)

Enter name of climate station; up to 20 characters.

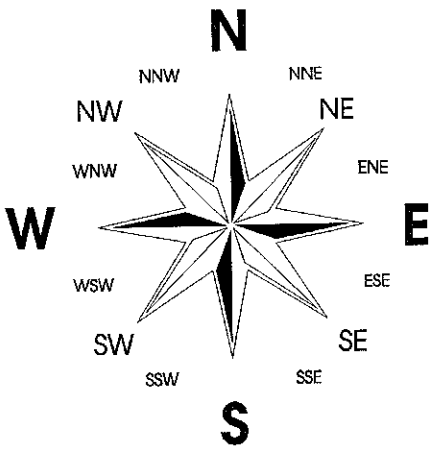
LATITUDE Latitude of station. Enter: N or S / degrees / minutes.

LONGITUDE Longitude of station. Enter: E or W / degrees / minutes.

ALTITUDE Enter altitude of station in m.a.s.l.; when below sea level, enter - (minus sign)

DISTANCE Enter distance in km between site and climate station.

DIRECTION Enter direction site --> climate station:



RELEVANCE Relevance of station's data to soil site (DAY (ed),1983):

V	**very good: site of station is identical to soil site**
G	**good: site of station and soil site are sufficiently similar to allow for macro and intermediate levels of climatic interpretations**
M	**moderate: sufficiently similar to allow for macro climatic interpretations**
P	**poor: no reliable climatic interpretations possible**

Enter **mean monthly** and **annual** figures for each variable.

DATA KIND Enter kind of variable:

CODE SHOULD BE ENTERED EXACTLY AS LISTED BELOW

T	**mean temperature in degrees Celsius**		
Ti	**minimum temperature**	**Ta**	**maximum temperature**
P	**precipitation in mm**	**Pd**	**number of rain days**
E	**potential evapotranspiration in mm**		
Et	**Thornthwaite**	**Ep**	**Penman**
Ef	**Frere, Popov**	**Eb**	**Blaney-Criddle**
Ea	**Papadakis**	**Eu**	**Turc**
A	**Actual evaporation in mm**		
Ao	**Class A pan**	**Ac**	**Colorado pan**
Ap	**Piche**		
H	**Relative humidity**	**e**	**Vapour pressure in mbar**
n	**hours of bright sunshine hrs/day**	**nN**	**percentage bright sunshine %**
R	**total global radiation $MJ.m^{-2}.day^{-1}$**	**Re**	**estimated total global radiation $MJ.m^{-2}.day^{-1}$**
U	**wind speed in m/sec at 2 m height**	**xa, xb, etc**	**specify in general remarks**

If the wind speed is measured at different height, it should be corrected to wind speed at 2 m height with the following factor:(Doorenbos and Pruitt, 1975)

Measuring height(m):	0.5	1	1.5	2	3	4	5	6	8	10
Correction factor:	1.35	1.15	1.06	1.0	0.93	0.88	0.85	0.83	0.81	0.80

$1MJ.m^{-2}$ = $23.885cal/cm^{-2}$ = 23.885 langley
= $27.778mWhr.cm^{-2}$
= 0.404mm water

If variable and/or method of recording is not included in the table: give a full description of variable and/or method in descriptive part.

PERIOD Number of years of record.

AF	Afghanistan
AL	Albania
DZ	Algeria
AS	American Samoa
AD	Andorra
AO	Angola
AI	Anguilla
AQ	Antarctica
AG	Antigua and Barbuda
AR	Argentina
AM	Armenia
AW	Aruba
AU	Australia
AT	Austria
AZ	Azerbaijan
BS	Bahamas
BH	Bahrain
BD	Bangladesh
BB	Barbados
BE	Belgium
BZ	Belize
BJ	Benin
BT	Bhutan
BO	Bolivia
BW	Botswana
BV	Bouvet Island
BR	Brazil
IO	British Indian Ocean Territory
BN	Brunei Darussalam
BG	Bulgaria
BF	Burkina Faso
BU	Burma
BI	Burundi
BY	Belarus
CM	Cameroon
CA	Canada
CV	Cape Verde
KY	Cayman Islands
CF	Central African Republic
TD	Chad
CL	Chile
CN	China
CX	Christmas Island
CC	Cocos Islands
CO	Colombia
CG	Congo
CK	Cook Islands
CR	Costa Rica
HR	Croatia
CU	Cuba
CY	Cyprus
CS	Czechoslovakia
CI	Côte d'Ivoire
DK	Denmark
DJ	Djibouti
DM	Dominica
DO	Dominican Republic
TP	East Timor
EC	Ecuador
EG	Egypt
SV	El Salvador
GQ	Equatorial Guinea
EE	Estonia
ET	Ethiopia
FK	Falkland Islands
FO	Faroe Islands
FJ	Fiji
FI	Finland
FR	France
GF	French Guiana
PF	French Polynesia
TF	French Southern Territories
GA	Gabon
GM	Gambia
GE	Georgia
DE	Germany Federal Republic of
GH	Ghana
GI	Gibraltar
GR	Greece
GL	Greenland
GD	Grenada
GP	Guadeloupe
GU	Guam
GT	Guatemala
GN	Guinea
GW	Guinea-Bissau
GY	Guyana
HT	Haiti
HM	Heard and McDonald Islands
HN	Honduras
HK	Hong Kong
HU	Hungary
IS	Iceland
IN	India
ID	Indonesia
IR	Iran Islamic Republic of
IQ	Iraq
IE	Ireland
IL	Israel
IT	Italy
JM	Jamaica
JP	Japan
JO	Jordan
KH	Kampuchea, democratic
KZ	Kazakhstan

KE	Kenya
KI	Kiribati
KR	Korea, Republic of
KP	Korea, Democratic Peoples Republic
KW	Kuwait
KG	Kyrgystan
LA	Lao People's Democratic Rep.
LB	Lebanon
LS	Lesotho
LR	Liberia
LY	Libyan Arab Jamahiriya
LI	Liechtenstein
LT	Lithuania
LU	Luxembourg
MO	Macau
MG	Madagascar
MW	Malawi
MY	Malaysia
MV	Maldives
ML	Mali
MT	Malta
MH	Marshall Islands
MQ	Martinique
MR	Mauritania
MU	Mauritius
MX	Mexico
FM	Micronesia
MD	Moldova, Republic of
MC	Monaco
MN	Mongolia
MS	Montserrat
MA	Morocco
MZ	Mozambique
NA	Namibia
NR	Nauru
NP	Nepal
NL	Netherlands
AN	Netherlands Antilles
NT	Neutral Zone
NC	New Caledonia
NZ	New Zealand
NI	Nicaragua
NE	Niger
NG	Nigeria
NU	Niue
NF	Norfolk Island
MP	Northern Mariana Islands
NO	Norway
OM	Oman
PK	Pakistan
PW	Palau
PA	Panama
PG	Papua New Guinea
PY	Paraguay
PE	Peru
PH	Philippines
PN	Pitcairn
PL	Poland
PT	Portugal
PR	Puerto Rico
QA	Qatar
RE	Reunion
RO	Romania
RU	Russian Federation
RW	Rwanda
LC	Saint Lucia
WS	Samoa
SM	San Marino
ST	Sao Tome and Principe
SA	Saudi Arabia
SN	Senegal
SC	Seychelles
SL	Sierra Leone
SG	Singapore
SB	Solomon Islands
SO	Somalia
ZA	South Africa
ES	Spain
LK	Sri Lanka
SH	St.Helena
KN	St.Kitts and Nevis
PM	St.Pierre and Miquelon
VC	St.Vincent and the Grenadines
SD	Sudan
SR	Suriname
SJ	Svalbard and Jan Mayen
SZ	Swaziland
SE	Sweden
CH	Switzerland
SY	Syrian Arab Republic
TW	Taiwan, Province China
TJ	Tajikistan
TZ	Tanzania, United Republic of
TH	Thailand
TG	Togo
TK	Tokelau
TO	Tonga
TT	Trinidad and Tobago
TN	Tunisia
TR	Turkey
TM	Turkmenistan
TC	Turks and Caicos Islands
TV	Tuvalu
SU	Ussr
UG	Uganda

UA	Ukraine
AE	United Arab Emirates
GB	United Kingdom
US	United States
UY	Uruguay
UM	US. Minor Outlying Islands
SU	Ussr (glinka)
UZ	Uzbekistan
VU	Vanuatu
VA	Vatican City State
VE	Venezuela
VN	Viet Nam
VG	Virgin Islands (U.K.)
VI	Virgin Islands (U.S.)
WF	Wallis and Futuna Islands
EH	Western Sahara
YE	Yemen
YU	Yugoslavia
ZR	Zaire
ZM	Zambia
ZW	Zimbabwe

A	**ACRISOLS**
Af	ferric acrisol
Ag	gleyic acrisol
Ah	humic acrisol
Ao	orthic acrisol
Ap	plinthic acrisol
B	**CAMBISOLS**
Bc	chromic cambisol
Bd	dystric cambisol
Be	eutric cambisol
Bf	ferralic cambisol
Bg	gleyic cambisol
Bh	humic cambisol
Bk	calcic cambisol
Bv	vertic cambisol
Bx	gelic cambisol
C	**CHERNOZEMS**
Cg	glossic chernozem
Ch	haplic chernozem
Ck	calcic chernozem
Cl	luvic chernozem
D	**PODZOLUVISOLS**
Dd	dystric podzoluvisol
De	eutric podzoluvisol
Dg	gleyic podzoluvisol
E	**RENDZINAS**
E	rendzina
F	**FERRALSOLS**
Fa	acric ferralsol
Fh	humic ferralsol
Fo	orthic ferralsol
Fp	plinthic ferralsol
Fr	rhodic ferralsol
Fx	xanthic ferralsol
G	**GLEYSOLS**
Gc	calcaric gleysol
Gd	dystric gleysol
Ge	eutric gleysol
Gh	humic gleysol
Gm	mollic gleysol
Gp	plinthic gleysol
Gx	gelic gleysol
H	**PHAEOZEM**
Hc	calcaric phaeozem
Hg	gleyic phaeozem
Hh	haplic phaeozem
Hl	luvic phaeozem
I	**LITHOSOL**
I	lithosol
J	**FLUVISOLS**
Jc	calcaric fluvisol
Jd	dystric fluvisol
Je	eutric fluvisol
Jt	thionic fluvisol
K	**KASTANOZEM**
Kh	haplic kastanozem
Kk	calcic kastanozem
Kl	luvic kastanozem
L	**LUVISOLS**
La	albic luvisol
Lc	chromic luvisol
Lf	ferric luvisol
Lg	gleyic luvisol
Lk	calcic luvisol
Lo	orthic luvisol
Lp	plinthic luvisol
Lv	vertic luvisol
M	**GREYZEMS**
Mg	gleyic greyzem
Mo	orthic greyzem
N	**NITOSOLS**
Nd	dystric nitosol
Ne	eutric nitosol
Nh	humic nitosol
O	**HISTOSOLS**
Od	dystric histosol
Oe	eutric histosol
Ox	gelic histosol
P	**PODZOLS**
Pf	ferric podzol
Pg	gleyic podzol
Ph	humic podzol
Pl	leptic podzol
Po	orthic podzol
Pp	placic podzol
Q	**ARENOSOLS**
Qa	albic arenosol
Qc	cambic arenosol
Qf	ferralic arenosol
Ql	luvic arenosol

R	**REGOSOLS**
Rc	calcaric regosol
Rd	dystric regosol
Re	eutric regosol
Rx	gelic regosol
S	**SOLONETZ**
Sg	gleyic solonetz
Sm	mollic solonetz
So	orthic solonetz
T	**ANDOSOLS**
Th	humic andosol
Tm	mollic andosol
To	ochric andosol
Tv	vitric andosol
U	**RANKERS**
U	ranker
V	**VERTISOLS**
Vc	chromic vertisol
Vp	pellic vertisol
W	**PLANOSOLS**
Wd	dystric planosol
We	eutric planosol
Wh	humic planosol
Wm	mollic planosol
Ws	solodic planosol
Wx	gelic planosol
X	**XEROSOLS**
Xh	haplic xerosol
Xk	calcic xerosol
Xl	luvic xerosol
Xy	gypsic xerosol
Y	**YERMOSOLS**
Yh	haplic yermosol
Yk	calcic yermosol
Yl	luvic yermosol
Yt	takyric yermosol
Yy	gypsic yermosol
Z	**SOLONCHAKS**
Zg	gleyic solonchak
Zm	mollic solonchak
Zo	orthic solonchak
Zt	takyric solonchak

Appendix III Codes FAO-Unesco 1988. Soil units and subunit prefixes.

AC	**Acrisols**
ACf	Ferric Acrisol
ACg	Gleyic Acrisol
ACh	Haplic Acrisol
ACp	Plinthic Acrisol
ACu	Humic Acrisol
AL	**Alisols**
ALf	Ferric Alisol
ALg	Gleyic Alisol
ALh	Haplic Alisol
ALj	Stagnic Alisol
ALp	Plinthic Alisol
ALu	Humic Alisol
AN	**Andosols**
ANg	Gleyic Andosol
ANh	Haplic Andosol
ANi	Gelic Andosol
ANm	Mollic Andosol
ANu	Umbric Andosol
ANz	Vitric Andosol
AR	**Arenosols**
ARa	Albic Arenosol
ARb	Cambic Arenosol
ARc	Calcaric Arenosol
ARg	Gleyic Arenosol
ARh	Haplic Arenosol
ARl	Luvic Arenosol
ARo	Ferralic Arenosol
AT	**Anthrosols**
ATa	Aric Anthrosol
ATc	Cumulic Anthrosol
ATf	Fimic Anthrosol
ATu	Urbic Anthrosol
CH	**Chernozems**
CHg	Gleyic Chernozem
CHh	Haplic Chernozem
CHk	Calcic Chernozem
CHl	Luvic Chernozem
CHw	Glossic Chernozem
CL	**Calcisols**
CLh	Haplic Calcisol
CLl	Luvic Calcisol
CLp	Petric Calcisol
CM	**Cambisols**
CMc	Calcaric Cambisol
CMd	Dystric Cambisol
CMe	Eutric Cambisol
CMg	Gleyic Cambisol
CMi	Gelic Cambisol
CMo	Ferralic Cambisol
CMu	Humic Cambisol
CMv	Vertic Cambisol
CMx	Chromic Cambisol
FL	**Fluvisols**
FLc	Calcaric Fluvisol
FLd	Dystric Fluvisol
FLe	Eutric Fluvisol
FLm	Mollic Fluvisol
FLs	Salic Fluvisol
FLt	Thionic Fluvisol
FLu	Umbric Fluvisol
FR	**Ferralsols**
FRg	Geric Ferralsol
FRh	Haplic Ferralsol
FRp	Plinthic Ferralsol
FRr	Rhodic Ferralsol
FRu	Humic Ferralsol
FRx	Xanthic Ferralsol
GL	**Gleysols**
GLa	Andic Gleysol
GLd	Dystric Gleysol
GLe	Eutric Gleysol
GLi	Gelic Gleysol
GLk	Calcic Gleysol
GLm	Mollic Gleysol
GLt	Thionic Gleysol
GLu	Umbric Gleysol
GR	**Greyzems**
GRg	Gleyic Greyzem
GRh	Haplic Greyzem
GY	**Gypsisols**
GYh	Haplic Gypsisol
GYk	Calcic Gypsisol
GYl	Luvic Gypsisol
GYp	Petric Gypsisol
HS	**Histosols**
HSf	Fibric Histosol
HSi	Gelic Histosol
HSl	Folic Histosol
HSs	Terric Histosol
HSt	Thionic Histosol
KS	**Kastanozems**
KSh	Haplic Kastanozem
KSk	Calcic Kastanozem
KSl	Luvic Kastanozem
KSy	Gypsic Kastanozem

LP	**Leptosols**
LPd	Dystric Leptosol
LPe	Eutric Leptosol
LPi	Gelic Leptosol
LPk	Rendzic Leptosol
LPm	Mollic Leptosol
LPq	Lithic Leptosol
LPu	Umbric Leptosol
LV	**Luvisols**
LVa	Albic Luvisol
LVf	Ferric Luvisol
LVg	Gleyic Luvisol
LVh	Haplic Luvisol
LVj	Stagnic Luvisol
LVk	Calcic Luvisol
LVv	Vertic Luvisol
LVx	Chromic Luvisol
LX	**Lixisols**
LXa	Albic Lixisol
LXf	Ferric Lixisol
LXg	Gleyic Lixisol
LXh	Haplic Lixisol
LXj	Stagnic Lixisol
LXp	Plinthic Lixisol
NT	**Nitisols**
NTh	Haplic Nitisol
NTr	Rhodic Nitisol
NTu	Humic Nitisol
PD	**Podzoluvisols**
PDd	Dystric Podzoluvisol
PDe	Eutric Podzoluvisol
PDg	Gleyic Podzoluvisol
PDi	Gelic Podzoluvisol
PDj	Stagnic Podzoluvisol
PH	**Phaeozems**
PHc	Calcaric Phaeozem
PHg	Gleyic Phaeozem
PHh	Haplic Phaeozem
PHj	Stagnic Phaeozem
PHl	Luvic Phaeozem
PL	**Planosols**
PLd	Dystric Planosol
PLe	Eutric Planosol
PLi	Gelic Planosol
PLm	Mollic Planosol
PLu	Umbric Planosol
PT	**Plinthosols**
PTa	Albic Plinthosol
PTd	Dystric Plinthosol
PTe	Eutric Plinthosol
PTu	Humic Plinthosol
PZ	**Podzols**
PZb	Cambic Podzol
PZc	Carbic Podzol
PZf	Ferric Podzol
PZg	Gleyic Podzol
PZh	Haplic Podzol
PZi	Gelic Podzol
RG	**Regosols**
RGc	Calcaric Regosol
RGd	Dystric Regosol
RGe	Eutric Regosol
RGi	Gelic Regosol
RGu	Umbric Regosol
RGy	Gypsic Regosol
SC	**Solonchaks**
SCg	Gleyic Solonchak
SCh	Haplic Solonchak
SCi	Gelic Solonchak
SCk	Calcic Solonchak
SCm	Mollic Solonchak
SCn	Sodic Solonchak
SCy	Gypsic Solonchak
SN	**Solonetz**
SNg	Gleyic Solonetz
SNh	Haplic Solonetz
SNj	Stagnic Solonetz
SNk	Calcic Solonetz
SNm	Mollic Solonetz
SNy	Gypsic Solonetz
VR	**Vertisols**
VRd	Dystric Vertisol
VRe	Eutric Vertisol
VRk	Calcic Vertisol
VRy	Gypsic Vertisol

Subunit

AA	Anthraqui
AB	Albi
AC	Alcali
AD	Aridi
AK	Acri
AL	Ali
AP	Abrupti
AR	Areni
BA	Bathi
CA	Calcari
CH	Chromi
DU	Duri
DY	Dystri
EU	Eutri
FE	Ferri
FH	Fibrihisti
FL	Fluvi
FR	Fragi
GE	Geli
GL	Gleyi
GR	Geri
GS	Glossi
GU	Grumi
GY	Gypsi
HI	Histi
HU	Humi
KA	Calci
LI	Lithi
LM	Lamelli
LU	Luvi
LX	Lixi
MA	Mazi
MH	Mollihumi
MO	Molli
NI	Niti
NY	Nudiyermi
OR	Orthi
OT	Orthothioni
PA	Pachi
PE	Pelli
PF	Petroferri
PG	Petrogypsi
PK	Petrocalci
PL	Placi
PN	Plani
PS	Petrosali
PT	Petri
RH	Rhodi
RP	Rupti
SA	Sali
SI	Silti
SO	Sodi
SQ	Plinthi
ST	Stagni
TH	Terrihisti
TK	Takyri
UH	Umbrihumi
UM	Umbri
VE	Verti
VT	Veti
XA	Xanthi
YE	Yermi

a	**ALFISOL**
aq	**aqualf**
aqw	albaqualf
aqd	duraqualf
aqf	fragiaqualf
aqg	glossaqualf
aqn	natraqualf
aqo	ochraqualf
aql	plinthaqualf
aqt	tropaqualf
aqm	umbraqualf
ab	**boralf**
abo	cryoboralf
abe	eutroboralf
abf	fragiboralf
abg	glossoboralf
abn	natriboralf
abb	paleboralf
ad	**udalf**
adc	agrudalf
adi	ferrudalf
adf	fragiudalf
agf	fraglossudalf
adg	glossudalf
ada	hapludalf
adn	natrudalf
adb	paleudalf
adt	tropudalf
au	**ustalf**
aud	durustalf
aua	haplustalf
aun	natrustalf
aub	paleustalf
aul	plinthustalf
aur	rhodustalf
ax	**xeralf**
axd	durixeralf
axa	haploxeralf
axn	natrixeralf
axb	palexeralf
axl	plinthoxeralf
axr	rhodoxeralf
d	**ARIDISOL**
dr	**argid**
drd	durargid
dra	haplargid
drj	nadurargid
drn	natrargid
drb	paleargid
do	**orthid**
dok	calciorthid
dom	camborthid
dod	durorthid
dog	gypsiorthid
dob	paleorthid
dos	salorthid
e	**ENTISOL**
eq	**aquent**
eqc	cryaquent
eqv	fluvaquent
eqa	haplaquent
eqw	hydraquent
eqs	psammaquent
eqi	sulfaquent
eqt	tropaquent
er	**arent**
er	arent
ev	**fluvent**
evc	cryofluvent
evp	torrifluvent
evt	tropofluvent
evd	udifluvent
evu	ustifluvent
evx	xerofluvent
eo	**orthent**
eoc	cryorthent
eop	torriorthent
eot	troporthent
eod	udorthent
eou	ustorthent
eox	xerorthent
es	**psamment**
esc	cryopsamment
esz	quartzipsamment
esp	torripsamment
est	tropopsamment
esd	udipsamment
esu	ustipsamment
esx	xeropsamment
h	**HISTOSOL**
hi	**fibrist**
hib	borofibrist
hic	cryofibrist
hil	luvifibrist
him	medifibrist
his	sphagnofibrist
hit	tropofibrist
hl	**folist**
hlb	borofolist
hlc	cryofolist
hlt	tropofolist
he	**hemist**
heb	borohemist
hec	cryohemist
hel	luvihemist
hem	medihemist
hei	sulfihemist
heo	sulfohemist
het	tropohemist

ha	**saprist**
har	borosaprist
hac	cryosaprist
ham	medisaprist
hat	troposaprist
i	**INCEPTISOL**
in	**andept**
inc	cryandept
ind	durandept
iny	dystrandept
ine	eutrandept
inw	hydrandept
inp	placandept
inv	vitrandept
iq	**aquept**
iqn	andaquept
iqc	cryaquept
iqf	fragiaquept
iqx	halaquept
iqa	haplaquept
iqh	humaquept
iqp	placaquept
iql	plinthaquept
iqs	sulfaquept
iqt	tropaquept
io	**ochrept**
ioc	cryochrept
iod	durochrept
ioy	dystrochrept
ioe	eutrochrept
iof	fragiochrept
iou	ustochrept
iox	xerochrept
ig	**plaggept**
ig	plaggept
it	**tropept**
ity	dystropept
ite	eutropept
ith	humitropept
its	sombritropept
itu	ustropept
im	**umbrept**
imc	cryumbrept
imf	fragiumbrept
ima	haplumbrept
imx	xerumbrept

m	**MOLLISOL**
mw	**alboll**
mwr	argialboll
mwn	natralboll
mq	**aquoll**
mqr	argiaquoll
mqk	calciaquoll
mqc	cryaquoll
mqd	duraquoll
mqa	haplaquoll
mqn	natraquoll
mb	**boroll**
mbr	argiboroll
mbk	calciboroll
mbc	cryoboroll
mba	haploboroll
mbn	natriboroll
mbb	paleboroll
mbv	vermiboroll
mr	**rendoll**
mr	rendoll
md	**udoll**
mdr	argiudoll
mda	hapludoll
mdb	paleudoll
mdv	vermudoll
mu	**ustoll**
mur	argiustoll
muk	calciustoll
mud	durustoll
mua	haplustoll
mun	natrustoll
mub	paleustoll
muv	vermustoll
mx	**xeroll**
mxr	argixeroll
mxk	calcixeroll
mxd	durixeroll
mxa	haploxeroll
mxn	natrixeroll
mxb	palexeroll
o	**OXISOL**
oq	**aquox**
oqg	gibbsiaquox
oqo	ochraquox
oql	plinthaquox
oqm	umbraquox
oh	**humox**
ohk	acrohumox
ohg	gibbsihumox
oha	haplohumox
ohs	sombrihumox

oo	**orthox**
ook	acrorthox
ooe	eutrorthox
oog	gibbsiorthox
ooa	haplorthox
oos	sombriorthox
oom	umbriorthox
op	**torrox**
op	torrox
ou	**ustox**
ouk	acrustox
oue	eutrustox
oua	haplustox
ous	sombriustox
s	**SPODOSOL**
sq	**aquod**
sqc	cryaquod
sqd	duraquod
sqf	fragiaquod
sqa	haplaquod
sqp	placaquod
sqs	sideraquod
sqt	tropaquod
si	**ferrod**
si	ferrod
sh	**humod**
shc	cryohumod
shf	fragihumod
sha	haplohumod
shp	placohumod
sht	tropohumod
so	**orthod**
soc	cryorthod
sof	fragiorthod
soa	haplorthod
sop	placorthod
sot	troporthod

u	**ULTISOL**
uq	**aquult**
uqw	albaquult
uqf	fragiaquult
uqo	ochraquult
uqb	paleaquult
uql	plinthaquult
uqt	tropaquult
uqm	umbraquult
uh	**humult**
uha	haplohumult
uhb	palehumult
uhl	plinthohumult
uhs	sombrihumult
uht	tropohumult
ud	**udult**
udf	fragiudult
uda	hapludult
udb	paleudult
udl	plinthudult
udr	rhodudult
udt	tropudult
uu	**ustult**
uua	haplustult
uub	paleustult
uul	plinthustult
uur	rhodustult
ux	**xerult**
uxa	haploxerult
uxb	palexerult
v	**VERTISOL**
vp	**torrert**
vp	torrert
vd	**udert**
vdr	chromudert
vdl	pelludert
vu	**ustert**
vur	chromustert
vul	pellustert
vx	**xerert**
vxr	chromoxerert
vxl	pelloxerert

Subgroup prefixes

AB	abruptic
ABØ4	abruptic aridic
ABØ8	abruptic cryic
AB1Ø	abruptic haplic
AB14	abruptic udic
AB16	abruptic xerollic
AE	aeric
AEØ3	aeric arenic
AEØ5	aeric grossarenic
AEØ6	aeric mollic
AEØ8	aeric humic
AEØ9	aeric tropic
AE1Ø	aeric umbric
AE12	aeric xeric
AL	albaquic
ALØ2	albaquultic
ALØ4	albic
ALØ8	albic glossic
AL1Ø	alfic
AL12	alfic arenic

AL13	alfic andeptic
AL16	alfic lithic
AN	andic
ANØ1	andeptic
ANØ3	andaquic
ANØ6	andic dystric
AN11	andeptic glossoboric
AN22	andic ustic
AN24	andaqueptic
AN3Ø	anthropic
AQ	aqualfic
AQØ2	aquentic
AQØ4	aqueptic
AQØ6	aquic
AQØ8	aquic arenic
AQ14	aquic duric
AQ16	aquic durorthidic
AQ18	aquic dystric
AQ24	aquic haplic
AQ26	aquic lithic
AQ31	aquic psammentic
AQ34	aquollic
AQ36	aquultic
AR	arenic
ARØ2	arenic aridic
ARØ3	arenic orthoxic
ARØ4	arenic plinthaquic
ARØ6	arenic plinthic
ARØ8	arenic rhodic
AR1Ø	arenic ultic
AR14	arenic umbric
AR16	arenic ustalfic
AR18	arenic ustollic
AR22	argiaquic
AR24	argiaquic xeric
AR26	argic
AR28	argic lithic
AR3Ø	argic pachic
AR32	argic vertic
AR34	aridic
AR36	aridic calcic
AR42	aridic duric
AR5Ø	aridic pachic
AR52	aridic petrocalcic
BO	boralfic
BOØ2	boralfic lithic
BOØ4	boralfic udic
BOØ6	borollic
BOØ8	borollic glossic
BO1Ø	borollic lithic
BO12	borollic vertic
CA	calcic
CAØ4	calcic pachic
CAØ6	calciorthidic
CA1Ø	calcixerollic
CA2Ø	cambic
CH	chromic
CHØ6	chromudic
CR	cryic
CR1Ø	cryic lithic
CR14	cryic pachic
CU	cumulic
CUØ2	cumulic udic
CUØ4	cumulic ultic
DU	durargidic
DUØ2	duric
DUØ8	durixerollic
DU1Ø	durixerollic lithic
DU11	durochreptic
DU12	durorthidic
DU14	durorthidic xeric
DYØ2	dystric
DYØ3	dystric entic
DYØ4	dystric fluventic
DYØ6	dystric lithic
DYØ8	dystropeptic
EN	entic
ENØ2	entic lithic
ENØ6	entic ultic
EP	epiaquic
EP1Ø	epiaquic orthoxic
EU	eutric
EUØ2	eutrochreptic
EUØ4	eutropeptic
FE	ferrudalfic
FI	fibric
FIØ2	fibric terric
FLØ2	fluvaquentic
FLØ6	fluventic
FL12	fluventic umbric
FR1Ø	fragiaquic
FR18	fragic
GLØ2	glossaquic
GLØ4	glossic
GL1Ø	glossic udic
GL12	glossic ustollic
GL14	glossoboralfic
GL16	glossoboric
GR	grossarenic
GRØ1	grossarenic entic
GRØ4	grossarenic plinthic
HA	haplaquodic
HAØ1	haplaquic
HAØ2	haplic
HAØ5	haplohumic
HAØ7	haploxerollic
HAØ9	hapludic
HA12	hapludollic
HA16	haplustollic
HE	hemic
HEØ2	hemic terric
HI	histic
HIØ2	histic lithic
HIØ6	histic pergelic
HU	humic
HUØ2	humic lithic

HUØ5	humic pergelic
HUØ6	humoxic
HU1Ø	humaqueptic
HY	hydric
HYØ2	hydric lithic
LE	leptic
LI	limnic
LIØ2	lithic
LIØ4	lithic mollic
LIØ6	lithic ruptic-alfic
LIØ7	lithic ruptic-argic
LIØ8	lithic ruptic-entic xerollic
LIØ9	lithic ruptic-entic
LI1Ø	lithic udic
LI11	lithic ruptic-xerorthentic
LI12	lithic ultic
LI13	lithic ruptic-ultic
LI14	lithic umbric
LI15	lithic ruptic-xerochreptic
LI16	lithic ustic
LI18	lithic ustollic
LI2Ø	lithic vertic
LI22	lithic xeric
LI24	lithic xerollic
MO	mollic
NAØ6	natric
OC	ochreptic
OR	orthidic
ORØ1	orthic
ORØ2	orthoxic
OX	oxic
PA	pachic
PAØ2	pachic udic
PAØ4	pachic ultic
PAØ6	paleorthidic
PAØ8	paleustollic
PA1Ø	palexerollic
PA2Ø	paralithic vertic
PE	pergelic
PEØ1	pergelic ruptic-histic
PEØ2	pergelic sideric
PEØ4	petrocalcic
PEØ6	petrocalcic ustalfic
PEØ8	petrocalcic ustollic
PE14	petrocalcic xerollic
PE16	petroferric
PE2Ø	petrogypsic
PK	placic
PK1Ø	plaggeptic
PK12	plaggic
PL	plinthaquic
PLØ4	plinthic
PLØ6	plinthudic
PS	psammaquentic
PSØ2	psammentic
QU	quartzipsammentic
RE	rendollic
RH	rhodic
RUØ2	ruptic-alfic
RUØ9	ruptic-lithic
RU11	ruptic-lithic entic
RU15	ruptic-lithic xerochreptic
RU17	ruptic-ultic
RU19	ruptic-vertic
SA	salorthidic
SAØ2	sapric
SAØ4	sapric terric
SI	sideric
SOØ4	sombrihumic
SP	sphagnic
SPØ2	sphagnic terric
SPØ4	spodic
SU	sulfic
TE	terric
THØ4	thapto-histic
THØ6	thapto-histic tropic
TO	torrertic
TOØ2	torrifluventic
TOØ4	torriorthentic
TOØ6	torripsammentic
TO1Ø	torroxic
TR	tropaquodic
TRØ2	tropeptic
TRØ4	tropic
AA	typic
UD	udertic
UDØ1	udalfic
UDØ2	udic
UDØ3	udollic
UDØ5	udorthentic
UD1Ø	udoxic
UL	ultic
UM	umbreptic
UMØ2	umbric
US	ustalfic
USØ2	ustertic
USØ4	ustic
USØ6	ustochreptic
USØ8	ustollic
US12	ustoxic
VE	vermic
VEØ2	vertic
XE	xeralfic
XEØ2	xerertic
XEØ4	xeric
XEØ8	xerollic

Appendix V Codes Soil Taxonomy (USDA/SCS) 1992. Orders, suborders and great groups.

A	**Histosol**
AA	**Folist**
AAA	Cryofolist
AAB	Tropofolist
AAC	Borofolist
AAD	Medifolist
AB	**Fibrist**
ABA	Sphagnofibrist
ABB	Cryofibrist
ABC	Borofibrist
ABD	Tropofibrist
ABE	Luvifibrist
ABF	Medifibrist
AC	**Hemist**
ACA	Sulfohemist
ACB	Sulfihemist
ACC	Luvihemist
ACD	Cryohemist
ACE	Borohemist
ACF	Tropohemist
ACG	Medihemist
AD	**Saprist**
ADA	Sulfosaprist
ADB	Sulfisaprist
ADC	Cryosaprist
ADD	Borosaprist
ADE	Troposaprist
ADF	Medisaprist
B	**Spodosol**
BA	**Aquod**
BAA	Cryaquod
BAB	Alaquod
BAC	Fragiaquod
BAD	Placaquod
BAE	Duraquod
BAF	Epiaquod
BAG	Endoaquod
BB	**Cryod**
BBA	Placocrod
BBB	Duricryod
BBC	Humicryod
BBD	Haplocryod
BC	**Humod**
BCA	Placohumod
BCB	Durihumod
BCC	Fragihumod
BCD	Haplohumod
BD	**Orthod**
BDA	Placorthod
BDB	Durorthod
BDC	Fragiorthod
BDD	Alorthod
BDE	Haplorthod

C	**Andisol**
CA	**Aquand**
CAA	Cryaquand
CAB	Placaquand
CAC	Duraquand
CAD	Vitraquand
CAE	Melanaquand
CAF	Epiaquand
CAG	Endoaquand
CB	**Cryand**
CBA	Gelicryand
CBB	Melanocryand
CBC	Fulvicryand
CBD	Hydrocryand
CBE	Vitricryand
CBF	Haplocryand
CC	**Torrand**
CCA	Vitritorrand
CD	**Xerand**
CDA	Vitrixerand
CDB	Melanoxerand
CDC	Haploxerand
CE	**Vitrand**
CEA	Ustivitrand
CEB	Udivitrand
CF	**Ustand**
CFA	Durustand
CFB	Haplustand
CG	**Udand**
CGA	Placudand
CGB	Durudand
CGC	Melanudand
CGD	Fulvudand
CGE	Hydrudand
CGF	Hapludand
D	**Oxisol**
DA	**Aquox**
DAA	Acraquox
DAB	Plinthaquox
DAC	Eutraquox
DAD	Haplaquox
DB	**Torrox**
DBA	Acrotorrox
DBB	Eutrotorrox
DBC	Haplotorrox
DC	**Ustox**
DCA	Sombriustox
DCB	Acrustox
DCC	Eutrustox
DCD	Kandiustox
DCE	Haplustox
DD	**Perox**
DDA	Sombriperox
DDB	Acroperox
DDC	Eutroperox

DDD	Kandiperox
DDE	Haploperox
DE	**Udox**
DEA	Sombriudox
DEB	Acrudox
DEC	Eutrudox
DED	Kandiudox
DEE	Hapludox
E	**Vertisol**
EA	**Aquert**
EAA	Salaquert
EAB	Duraquert
EAC	Natraquert
EAD	Calciaquert
EAE	Dystraquert
EAF	Epiaquert
EAG	Endoaquert
EB	**Cryert**
EBA	Humicryert
EBB	Haplocryert
EC	**Xerert**
ECA	Durixerert
ECB	Calcixerert
ECC	Haploxerert
ED	**Torrert**
EDA	Salitorrert
EDB	Gypsitorrert
EDC	Calcitorrert
EDD	Haplotorrert
EE	**Ustert**
EEA	Dystrustert
EEB	Salustert
EEC	Gypsiustert
EED	Calciustert
EEE	Haplustert
EF	**Udert**
EFA	Dystrudert
EFB	Hapludert
F	**Aridisol**
FA	**Argid**
FAA	Nadurargid
FAB	Durargid
FAC	Natrargid
FAD	Paleargid
FAE	Haplargid
FB	**Orthid**
FBA	Salorthid
FBB	Paleorthid
FBC	Durorthid
FBD	Gypsiorthid
FBE	Calciorthid
FBF	Camborthid

G	**Ultisol**
GA	**Aquult**
GAA	Plinthaquult
GAB	Fragiaquult
GAC	Albaquult
GAD	Kandiaquult
GAE	Kanhaplaquult
GAF	Paleaquult
GAG	Umbraquult
GAH	Epiaquult
GAI	Endoaquult
GB	**Humult**
GBA	Sombrihumult
GBB	Plinthohumult
GBC	Kandihumult
GBD	Kanhaplohumult
GBE	Palehumult
GBF	Haplohumult
GC	**Udult**
GCA	Plinthudult
GCB	Fragiudult
GCC	Kandiudult
GCD	Kanhapludult
GCE	Paleudult
GCF	Rhodudult
GCG	Hapludult
GD	**Ustult**
GDA	Plinthustult
GDB	Kandiustult
GDC	Kanhaplustult
GDD	Paleustult
GDE	Rhodustult
GDF	Haplustult
GE	**Xerult**
GEA	Palexerult
GEB	Haploxerult
H	**Mollisol**
HA	**Alboll**
HAA	Natralboll
HAB	Argialboll
HB	**Aquoll**
HBA	Cryaquoll
HBB	Duraquoll
HBC	Natraquoll
HBD	Calciaquoll
HBE	Argiaquoll
HBF	Epiaquoll
HBG	Endoaquoll
HC	**Rendoll**
HD	**Xeroll**
HDA	Durixeroll
HDB	Natrixeroll
HDC	Palexeroll
HDD	Calcixeroll
HDE	Argixeroll
HDF	Haploxeroll
HE	**Boroll**

HEA	Paleboroll
HEB	Cryoboroll
HEC	Natriboroll
HED	Argiboroll
HEE	Vermiboroll
HEF	Calciboroll
HEG	Haploboroll
HF	**Ustoll**
HFA	Durustoll
HFB	Natrustoll
HFC	Paleustoll
HFD	Calciustoll
HFE	Argiustoll
HFF	Vermustoll
HFG	Haplustoll
HG	**Udoll**
HGA	Paleudoll
HGB	Calciudoll
HGC	Argiudoll
HGD	Vermudoll
HGE	Hapludoll
I	**Alfisol**
IA	**Aqualf**
IAA	Plinthaqualf
IAB	Duraqualf
IAC	Natraqualf
IAD	Fragiaqualf
IAE	Kandiaqualf
IAF	Glossaqualf
IAG	Albaqualf
IAH	Umbraqualf
IAI	Epiaqualf
IAJ	Endoaqualf
IB	**Boralf**
IBA	Paleboralf
IBB	Fragiboralf
IBC	Natriboralf
IBD	Cryoboralf
IBE	Eutroboralf
IBF	Glossoboralf
IC	**Ustalf**
ICA	Durustalf
ICB	Plinthustalf
ICC	Natrustalf
ICD	Kandiustalf
ICE	Kanhaplustalf
ICF	Paleustalf
ICG	Rhodustalf
ICH	Haplustalf
ID	**Xeralf**
IDA	Durixeralf
IDB	Natrixeralf
IDC	Fragixeralf
IDD	Plinthoxeralf
IDE	Rhodoxeralf
IDF	Palexeralf
IDG	Haploxeralf

IE	**Udalf**
IEA	Agrudalf
IEB	Natrudalf
IEC	Ferrudalf
IED	Fraglossudalf
IEE	Glossudalf
IEF	Fragiudalf
IEG	Kandiudalf
IEH	Kanhapludalf
IEI	Paleudalf
IEJ	Rhodudalf
IEK	Hapludalf
J	**Inceptisol**
JA	**Aquept**
JAA	Sulfaquept
JAB	Placaquept
JAC	Halaquept
JAD	Fragiaquept
JAE	Cryaquept
JAF	Plinthaquept
JAG	Tropaquept
JAH	Humaquept
JAI	Epiaquept
JAJ	Endoaquept
JB	**Plaggept**
JC	**Tropept**
JCA	Humitropept
JCB	Sombritropept
JCC	Ustropept
JCD	Eutropept
JCE	Dystropept
JD	**Ochrept**
JDA	Sulfochrept
JDB	Fragiochrept
JDC	Durochrept
JDD	Cryochrept
JDE	Ustochrept
JDF	Xerochrept
JDG	Eutrochrept
JDH	Dystrochrept
JE	**Umbrept**
JEA	Fragiumbrept
JEB	Cryumbrept
JEC	Xerumbrept
JED	Haplumbrept
K	**Entisol**
KA	**Aquent**
KAA	Sulfaquent
KAB	Hydraquent
KAC	Cryaquent
KAD	Psammaquent
KAE	Fluvaquent
KAF	Epiaquent
KAG	Endoaquent
KB	**Arent**
KBA	Ustarent

KBB	Xerarent	KDB	Xerofluvent
KBC	Torriarent	KDC	Ustifluvent
KBD	Udarent	KDD	Torrifluvent
KC	**Psamment**	KDE	Tropofluvent
KCA	Cryopsamment	KDF	Udifluvent
KCB	Torripsamment	**KE**	**Orthent**
KCC	Quartzipsamment	KEA	Cryorthent
KCD	Tropopsamment	KEB	Torriorthent
KCE	Ustipsamment	KEC	Xerorthent
KCF	Xeropsamment	KED	Troporthent
KCG	Udipsamment	KEE	Ustorthent
KD	**Fluvent**	KEF	Udorthent
KDA	Cryofluvent		

Appendix VI Codes Soil Taxonomy (USDA/SCS) for texture and mineralogy.

Texture

ØØ5	ashy
ØØ7	ashy over cindery
ØØ8	ashy over loamy
Ø13	ashy over loamy-skeletal
ØØ9	ashy-skeletal
ØØ3	cindery
ØØ6	cindery over loamy
Ø17	cindery over medial
Ø15	cindery over medial-skeletal
ØØ4	cindery over sandy or sandy-skeletal
114	clayey
122	clayey over fine-silty
116	clayey over fragmental
124	clayey over loamy
12Ø	clayey over loamy-skeletal
118	clayey over sandy or sandy-skeletal
Ø56	clayey-skeletal
Ø58	clayey-skeletal over sandy
ØØØ	coarse-loamy
Ø86	coarse-loamy over clayey
Ø82	coarse-loamy over fragmental
Ø84	coarse-loamy over sandy or sandy-skeletal
Ø88	coarse-silty
Ø94	coarse-silty over clayey
Ø92	coarse-silty over sandy or sandy-skeletal
126	fine
115	fine clayey
Ø96	fine-loamy
1Ø2	fine-loamy over clayey
Ø98	fine-loamy over fragmental
1ØØ	fine-loamy over sandy or sandy-skeletal
1Ø6	fine-silty
112	fine-silty over clayey
1Ø8	fine-silty over fragmental
11Ø	fine silty over sandy or sandy-skeletal
Ø36	fragmental
15Ø	gravelly
Ø68	loamy
Ø72	loamy over sandy or sandy-skeletal
Ø5Ø	loamy skeletal
Ø54	loamy-skeletal over clayey
Ø51	loamy-skeletal over fragmental
Ø52	loamy-skeletal over sandy
Ø7Ø	loamy sandy
Ø65	loamy to sandy
Ø1Ø	medial
Ø12	medial over cindery
Ø14	medial over clayey
Ø16	medial over fragmental
Ø18	medial over loamy
Ø2Ø	medial over loamy-skeletal
Ø22	medial over sandy or sandy-skeletal
Ø24	medial over thixotropic
Ø11	medial-skeletal
Ø62	sandy
Ø63	sandy or sandy-skeletal
Ø66	sandy over clayey
Ø64	sandy over loamy
Ø44	sandy skeletal
Ø47	sandy-skeletal over clayey
Ø46	sandy-skeletal over loamy
Ø26	thixotropic
Ø28	thixotropic over fragmental
Ø34	thixotropic over loamy
Ø32	thixotropic over loamy skeletal
Ø3Ø	thixotropic over sandy or sandy-skeletal
Ø27	thixotropic-skeletal
134	very fine

Ø4	calcareous
Ø5	carbonatic
Ø9	chloritic
Ø7	clastic
Ø8	coprogenous
1Ø	diatomaceous
12	ferrihumic
14	ferritic
18	gibbsitic
2Ø	glauconitic
22	gypsic
24	halloysitic
26	illitic
27	illitic (calcareous)
28	kaolinitic
3Ø	marly
32	micaceous
34	mixed
35	mixed (calcareous)
37	montmorillonitic
38	montmorillonitic (calcareous)
4Ø	oxidic
42	sepiolitic
44	serpentinitic
46	siliceous
5Ø	vermiculitic

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