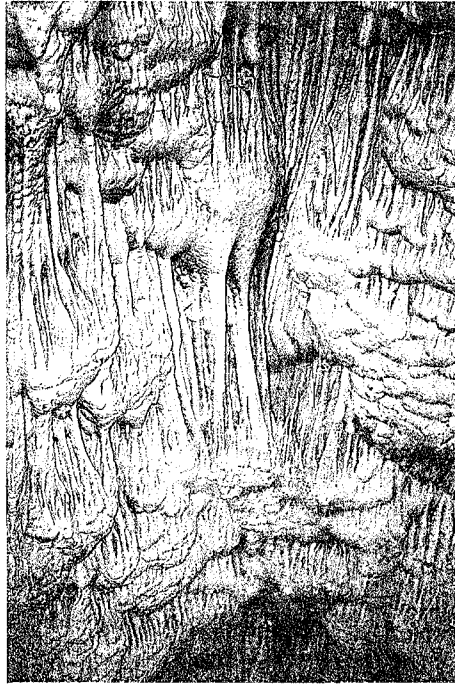

6

Inland rocks, screes and sands



61 Screes

Thlaspietea rotundifolii p., *Drypetea spinosae* i.a.

Vegetated or sparsely vegetated and frequently unstable areas of stones, boulders or rubble on steep slopes, produced by erosion in mountainous terrain. They are mostly developed in the Alps, the Pyrenees and the Mediterranean mountains and hills.

(Lebrun *et al.*, 1949; Rechinger, 1951; Braun-Blanquet, 1954, 1975, 1977; Ellenberg, 1963, 1988; Archiloque *et al.*, 1969; Schaer *et al.*, 1972; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Fernandez Casas, 1975; Ratcliffe, 1977; Gruber, 1978; Bournérias, 1979, 1984; Molinier and Martin, 1980; Strid, 1980; Ozenda, 1981, 1985; Fernandes Casas and Ceballos Jimenez, 1982; Pignatti, 1982; Duvigneaud, 1982; Prieto Fernandez, 1983; Lippert, 1983; Géhu, 1984; Rivas-Martinez, Diaz *et al.*, 1984; Dupias, 1985; Peinado Lorca and Rivas-Martinez, 1987; Martinez Parras *et al.*, 1987; Salomez *in litt.*, 1990; Jonglet *in litt.*, 1990; Oberdorfer, 1990)

- 61.1 ALPINE AND NORTHERN SILICEOUS SCREES**
Androsacetalia alpinae p., *Galeopsietalia segetum*
 Siliceous screes of high altitudes and cool sites within the Alpine system and the Pyrenees, of the Jura and Hercynian ranges and of middle European uplands.
- 61.11 ALPINE SILICEOUS SCREES**
Androsacion alpinae
 Siliceous, cool, damp screes of the subalpine and alpine levels of the Alps and the Pyrenees, with *Androsace alpina*, *Achillea nana*, *Oxyria digyna*, *Geum reptans*, *Saxifraga bryoides*, *Ranunculus glacialis*, *Linaria alpina*.
- 61.111 Mountain sorrel screes**
Oxyrietum digynae i.a.
 Typical Alpine and Pyrenean stabilized silicate screes, poor in humus, characterized by *Oxyria digyna* and with *Cerastium uniflorum*, *Doronicum clusii*, *D. grandiflorum*, *Poa laxa*.
- 61.1111 Alpine mountain sorrel screes**
Oxyrietum digynae i.a.
 Formations of most of the Alpine system.
- 61.1112 South-western Alpine mountain sorrel screes**
Thlaspeetum limosellifolii
 Local formations comprising the endemics *Viola valderia* and *Thlaspi limosellifolium*.
- 61.1113 Pyrenean mountain sorrel screes**
Oxyrio digynae-Doronicetum viscosae i.a.
 Stabilized silicate screes of the Pyrenees.
- 61.112 Rock jasmine screes**
Androsacetum alpinae
 Stony silicate screes of the high alpine and nival levels of the central Alps, with *Androsace alpina*.
- 61.113 Alpine woodrush screes**
Luzuletum spadiceae
 Humid, humus-rich silicate screes of slopes long-covered with snow, carpeted by the alpine woodrush, *Luzula alpinopilosa*.

- 61.114** **Cold silicate block screes**
Rubro-Dryopteridetum disjunctae
 Non-stabilized, shady subalpine silicate screes with a high proportion of large blocks, colonized by ferns and brambles.
- 61.12** **NORTHERN UPLAND SILICEOUS SCREES**
Galeopsis segetum
 Siliceous screes of hills of Western and Central Europe, with *Epilobium collinum*, *Galeopsis segetum*, *Senecio viscosus*, *Anarrhinum bellidifolium*, *Cryptogramma crispa*. Upland siliceous screes, often resulting from quarry activity, and colonized by very impoverished forms of the Alpine communities, usually rich in mosses, lichens and sometimes ferns, notably *Cryptogramma crispa*, are included.
- 61.2** **ALPINE CALCAREOUS SCREES**
Thlaspietalia rotundifolii p., *Drabetalia hoppeanae*
 Calcareous and calcschist screes of high altitudes and cool sites of the Alps and, locally, of peri-Alpine ranges.
- 61.21** **ALPINE CALCSCHIST SCREES**
Drabion hoppeanae
 Calcareous slate slope communities of the Alps, with *Draba hoppeana*, *Campanula cenisia*, *Saxifraga biflora*, *Herniaria alpina*, *Trisetum spicatum*.
- 61.22** **ALPINE PENNYCRESS SCREES**
Thlaspiion rotundifolii: *Thlaspietum rotundifolii* i.a.
 Unstable, hard limestone and dolomite coarse screes of the alpine and nival levels of the Alps, with *Thlaspi rotundifolium*, *Papaver rhaeticum*, *P. sendtneri*, *Viola cenisia*, *Linaria alpina*, *Arabis alpina*.
- 61.23** **FINE CALCAREOUS SCREES**
Petasition paradoxo, *Thlaspiion rotundifolii*: *Leontodontetum montani* i.a.
 Fine-element calcareous screes of the alpine, subalpine and high montane levels of the Alps and neighbouring ranges.
- 61.231** **Butterbur screes**
Petasition paradoxo
 High montane and subalpine, relatively humid, fine limestone and marl screes, with *Petasites paradoxus*, *Valeriana montana*, *Gypsophila repens*.
- 61.232** **Mountain hawkbit screes**
Leontodontetum montani i.a.
 Damp, marlo-calcareous screes of the alpine level of the Alps.
- 61.2321** **Central Alpine mountain hawkbit screes**
Leontodontetum montani
 Screes of the north-western and central Alps, with *Leontodon montanus*, *Ranunculus parnassifolius*, *Saxifraga biflora*.
- 61.2322** **Berardia screes**
Berardietum lanuginosi
 Screes of the south-western Alps, with the spectacular endemics *Berardia subacaulis* and *Brassica repanda* ssp. *repanda*.
- 61.3** **WESTERN MEDITERRANEAN AND THERMOPHILOUS SCREES**
Androsacetalia alpinae p., *Thlaspietalia rotundifolii* p., *Stipetalia calamagrostis*, *Polystichetalia lonchitis*
 Screes of warm exposures in the Alps and the Pyrenees, of calcareous substrates in the Pyrenees, of Mediterranean mountains, hills and lowlands and, locally, of warm, sunny middle European upland or lowland sites.
- 61.31** **PERI-ALPINE THERMOPHILOUS SCREES**
Stipion calamagrostidis, *Leontodontion hyoseroidis*
 Mostly coarse, unstabilized, sunny calcareous screes of the montane and subalpine levels of the Alps and of the uplands and lowlands of middle, central and western Europe.

- 61.311** **Rough-grass screes**
Stipetum calamagrostidis, *Calamagrostido-Centranthetum angustifolii*
Achnatherum calamagrostis screes of warmer, lower parts of Alpine valleys and of the south-western outer Alps.
- 61.312** **Sub-montane calcareous screes**
- 61.3121** **Hemp-nettle screes**
 Galeopsietum angustifoliae
 Galeopsis angustifolia communities of central Europe.
- 61.3122** **French sorrel screes**
 Rumicetum scutati
 Pioneering community of dry screes of south-western central Europe.
- 61.3123** **Limestone fern screes**
 Gymnocarpietum robertiani
 Fern swards of *Gymnocarpium robertianum* colonizing often slightly damp screes.
- 61.313** **Paris Basin screes**
Leontodontion hyoseroidis
Calcareous screes of the Paris Basin and its periphery, with *Leontodon hyoseroides*, *Sisymbrium supinum*, *Linaria supina*, *Galeopsis angustifolia* and many rare or endemic plants, including *Viola hispida* (endangered endemic), *Galium timeroyi* ssp. *fleurotii*, *Iberis violetii*, *I. durandii*, *Biscutella neustriaca*.
- 61.32** **PROVENÇAL SCREES**
Pimpinello-Gouffeion
Screes of Mediterranean southern France, with *Gouffeia arenarioides*, *Ptychotis heterophylla*, *Linaria supina*, *Centranthus ruber*, *Crucianella latifolia*.
- 61.33** **PYRENEO-ALPINE THERMO-SILICEOUS SCREES**
Senecion leucophyllae, *Taraxacion pyrenaici*
Siliceous screes of warm slopes of the subalpine level of the Alps and of the alpine and subalpine levels of the Pyrenees, usually composed largely of big stones or boulders, with *Senecio leucophyllus*, *Taraxacum pyrenaicum*, *Galeopsis pyrenaica*, *Xatartia scabra*, *Armeria alpina*.
- 61.34** **PYRENEAN CALCAREOUS SCREES**
Iberidion spathulatae
Calcareous screes of the Pyrenees.
- 61.341** **Fine Pyrenean calcareous screes**
Fine limestone or calcschists on gentle slopes of the alpine level, with *Iberis spathulata*, *Papaver suaveolens*, *Galium cometerhizon*, *Plantago monosperma*, *Viola lapeyrousiana*, *Campanula jaubertiana*.
- 61.342** **Coarse Pyrenean calcareous screes**
Coarse, relatively dry screes on steep slopes, forming debris cones at the foot of cliffs, with *Crepis pygmaea*, *Doronicum grandiflorum*, *Campanula cochleariaefolia*, *Carduus carlinoides*, *Galium cespitosum*, *Festuca glacialis*.
- 61.343** **High Pyrenean calcareous screes**
Flattish screes of high altitudes of the central Pyrenees, with *Androsace ciliata*, *Saxifraga oppositifolia*, *Hutchinsia alpina*, *Galium pyrenaicum*, *Minuartia cerastiifolia*.
- 61.344** **Humid Pyrenean calcareous screes**
Damp, cool screes with prolonged snow cover, with *Saxifraga praetermissa*, *S. aizoides*, *Epilobium anagallidifolium*, *Veronica alpina*, *Taraxacum alpinum*.
- 61.345** **Subalpine Pyrenean calcareous screes**
Calcareous screes developed at the foot of the cliffs of the great calcareous ranges, with *Crepis pygmaea*, *Carduus carlinoides* and the endemics *Borderea pyrenaica*, *Cirsium glabrum*, *Lithospermum gastonis*, *Iberis bernardiana*, *Armeria pubinervis*.

- 61.35** ORO-CANTABRIAN CALCAREOUS SCREES
Linarion filicaulis, *Saxifragion praetermissae*
Basiphile screes of the Cordillera Cantabrica.
- 61.351** Oro-Cantabrian mobile calcareous screes
Alti-montane, subalpine and alpine unstabilized calcareous screes of the Cordillera Cantabrica, made of stones of medium size, with *Linaria filicaulis*, *Arabis cantabrica*, *Iberis lereschiana*, *Ranunculus parnassifolius* ssp. *favargerii*, *Crepis pygmaea*.
- 61.352** Fine oro-Cantabrian calcareous screes
Fine screes of the collinar and montane levels, with *Iberis aperta* and *Rumex scutatus*.
- 61.353** Chionophilous oro-Cantabrian calcareous screes
Somewhat stabilized coarse screes of the subalpine and alpine levels, subjected to prolonged snow cover, characterized by *Epilobium anagallidifolium*, *Doronicum grandiflorum* ssp. *braunblanquetii* and *Campanula arvatica*.
- 61.354** Seeping oro-Cantabrian calcareous screes
Fine screes of the subalpine and alpine levels, submitted to prolonged snow cover and waterlogging, with *Saxifraga praetermissa*, *Arabis cantabrica* and *Ranunculus alpestris* ssp. *leroyi*.
- 61.355** Oro-Cantabrian calcareous lapiaz screes
Screes developed on the surface of frost-broken rocks in areas of short snow cover in the alpine and subalpine levels, with *Salix breviserrata* and *Galium pyrenaicum*.
- 61.36** ORO-CANTABRIAN SILICEOUS SCREES
Linarion filicaulis p., *Linario-Senecion carpetani* p.
Siliceous screes of the Cordillera Cantabrica; floristically rich formations of the 'dark' screes of the Cordillera are related to those of 61.351, though somewhat intermediate towards 61.38; other more species-poor ones, characterized by *Trisetum hispidum* and *Rumex suffruticosus*, belong to the latter.
- 61.37** IBERIAN FERN SCREES
Dryopteridion oreadis, *Dryopteridion submontanae*
Fern-dominated chaotic, boulder fields of siliceous and calcareous Iberian mountains.
- 61.38** CARPETANO-IBERIAN SILICEOUS SCREES
Linario-Senecion carpetani
Screes of the Cordillera Central, the Iberian Range, the Leonese mountains, with *Linaria saxatilis*, *L. alpina*, *Digitalis purpurea* var. *carpetana*, *Senecio pyrenaicus* ssp. *carpetanus*, *Rumex suffruticosus*, *Santolina oblongifolia*, *Conopodium butinioides*, *Reseda gredensis*.
- 61.39** NEVADAN SILICEOUS SCREES
Holcicon caespitosae
Siliceous screes of the high levels of the Sierra Nevada, very rich in endemics.
- 61.391** Nevadan foxglove screes
Digitali purpureae-Senecietum granatensis
Screes at the sub-summital levels of the Sierra Nevada, between 1 900 and 2 900 m, with *Senecio tournefortii* var. *granatensis*, *Digitalis purpurea* var. *nevadensis*, *Cirsium gregarium*, *Solidago virgaurea* var. *alpestris*, *Holcus caespitosus*, *Crepis oporinoides*, *Eryngium glaciale*, *Linaria aeruginea* var. *nevadensis*.
- 61.392** Nevadan violet screes
Violo-Linarietum glacialis
Screes of the summital region of the Sierra Nevada, at around 2 800-3 000 m, with a very sparse community formed by *Viola crassiuscula*, *Linaria glacialis*, *Rhynchosinapis cheiranthos* ssp. *nevadensis*, *Ranunculus glacialis*, *R. parnassifolius*, *Saxifraga oppositifolia*, *Papaver suaveolens*, *Holcus caespitosus*, *Crepis oporinoides* and, in more stabilized areas, *Erigeron frigidus*.

61 Screes

- 61.3A** SOUTHERN IBERIAN CALCAREOUS SCREES
Platycapno-Iberidion granatensis, *Scrophularion sciaphilae*
Screes of the calcareous Baetic mountains of southern and south-eastern Iberia.
- 61.3B** CENTRAL MEDITERRANEAN SCREES
Screes of the Italian peninsula and of the large Mediterranean islands.
- 61.4** EASTERN MEDITERRANEAN SCREES
Drypetalia spinosae
Screes of the high Greek mountains.
- 61.41** GREEK LIMESTONE SCREES
Drypion spinosae (*Silenion caesia*)
Formations of the higher mountains of Greece, with *Drypis spinosa*, *Ranunculus brevifolius*, *Senecio thapsoides*, *Aethionema saxatile*.
- 61.411** Northern mainland screes
Calcareous screes of the northern and central Pindus, with *Geranium aristatum*, *Achillea abrotanoides*, *Arenaria conferta*.
- 61.412** Olympus screes
Screes of Olympus, with *Asperula muscosa*, *Rhynchosinapis nivalis*, *Alyssum handelii*, *Achillea ambrosiaca*.
- 61.413** Southern mainland screes
Screes of Parnassus, Giona and other southern Pindus ranges, with *Astragalus hellenicus*, *Corydalis bulbosa*, *Sclerochorton junceum*, *Euphorbia deflexa*, *Geranium macrorrhizum*, *Rumex scutatus*.
- 61.414** Peloponnese calcareous screes
Screes of the Taygetos, Kilini and other Peloponnese ranges, with *Valantia aprica*, *Minuartia juniperina*.
- 61.415** Aegean screes
Screes of Crete and Carpathos.
- 61.42** GREEK SERPENTINE SCREES
Campanulion hawkinsoniana
Less widespread formations restricted to serpentines of the Pindus, with *Campanula hawkinsoniana*, *Arenaria serpentini*, *Cardamine glauca*, *Viola magellensis*, *Alyssum scardicum*, *Silene haussknechtii*.

62 Inland cliffs and exposed rocks

Asplenietea trichomanis, *Adiantetia capilli-veneris* i.a.

Cliffs, rock faces, limestone pavements, the plant communities that colonize their cracks, and their associated animal communities.

(Rechinger, 1951; Braun-Blanquet, 1954; Lausi and Poldini, 1962; Niklfeld, 1962; Archiloque *et al.*, 1969; Sutter, 1973; Horvat *et al.*, 1974; Ratcliffe, 1977; Gruber, 1978; Bellot Rodriguez, 1979; Molinier and Martin, 1980; Strid, 1980; Ozenda, 1981, 1985; Pignatti, 1982; Prieto Fernandez, 1983; Géhu, 1984; Bournérias, 1984; Rivas-Martinez, Diaz *et al.*, 1984; Dupias, 1985; Aparicio Martinez and Silvestre Domingo, 1987; Sfikas, 1987; Peinado Lorca and Rivas-Martinez, 1987; Martinez Parras *et al.*, 1987; Ellenberg, 1988; Iatridis, 1988; Salomez *in litt.*, 1990; Jonglet *in litt.*, 1990; Oberdorfer, 1990)

62.1

VEGETATED CALCAREOUS INLAND CLIFFS

Potentilletalia caulescentis, *Asplenietalia glandulosae*, *Onosmetalia frutescentis*, *Potentilletalia speciosae*

Dry, calcareous inland cliffs and their communities. Specific plant associations colonize montane and Mediterranean cliffs. Most of the subdivisions below refer to them. Northern lowland cliffs usually support fragments of communities listed in other chapters.

62.11

WESTERN EU-MEDITERRANEAN AND ORO-IBERIAN CALCAREOUS CLIFFS

Calcareous cliffs of the lower Mediterranean levels of the western Mediterranean and, locally, the northern Adriatic, and of the Iberian mountains.

62.111

Western eu-Mediterranean calcareous cliffs

Asplenietalia glandulosae

Calcareous cliffs of the Mediterranean region of Spain, of the lowest Mediterranean levels of France, of north-western Italy, of Sardinia and of the karstic region of north-eastern Italy.

62.1111

Ibero-Mediterranean calcareous cliffs

Asplenion petrarchae, *Poterion ancistroidis*

Calcareous and dolomitic cliffs of the Mediterranean hills and mountains of Spain, from Catalonia to the Serrania de Ronda, and of the thermo- and lower meso-Mediterranean levels of the coastal chains of Provence and Bas-Languedoc, of the southern Cévennes and of Sardinia, with *Asplenium petrarchae*, *Phagnalon sordidum*, *Sarcocapnos enneaphylla*, *Biscutella frutescens*, *Hieracium stelligerum*, *Lavatera maritima*, *Campanula macrorhiza*, *Melica minuta*, *M. bauhini*.

62.1112

South-eastern Iberian calcareous cliffs

Teucrium buxifolii

Calcareous cliffs of the arid south-eastern regions of Spain, with large shrubs; *Scabiosa saxatilis*, *Teucrium buxifolium*, *Rhamnus lycioides* ssp. *borgiae* are characteristic.

62.1113

Balearic calcareous cliffs

Brassico-Helichryson rupestris

Calcareous cliffs of the Balearics, with many endemics, including *Brassica balearica* and *Helichrysum rupestre* var. *cambessedesii*.

- 62.1114** **Triestine karst cliffs**
Centaureo-Campanulion
Cliffs of the karst region of north-eastern Italy, with *Centaurea kartschiana*, *Cheiranthus cheiri*, *Campanula pyramidalis*, *Teucrium flavum*, *Euphorbia wulfenii*, *Satureja thymifolia*.
- 62.1115** **Mediterranean fern cliffs**
Polypodium serrati
Cool, shaded calcareous cliffs of the west Mediterranean regions, with mostly bryophytes and ferns (*Polypodium cambricum*), and with *Selaginella denticulata*.
- 62.112** **Ibero-montane calcareous cliffs**
Potentilletalia caulescentis p.
Cliffs of the supra- and oro-Mediterranean levels of calcareous Iberian mountains.
- 62.1121** **Oro-Cantabrian calcareous cliffs**
Saxifragion trifurcato-canaliculatae
Calcareous cliffs of the Cantabrian Cordillera and a few other north-western Iberian ranges, with *Asperula hirta*, *Asplenium viride*, *Erinus alpinus*, *Globularia repens*, *Hypericum nummularium*, *Rhamnus pumilus*, *Saxifraga aretioides*.
- 62.1122** **Baetic calcareous cliffs**
Saxifragion camposii
Calcareous cliffs of high altitudes of Baetic and sub-Baetic ranges of eastern Andalusia, with *Linaria verticillata*, *Potentilla caulescens*, *Saxifraga camposii*, *S. erioblasta*, *Teucrium rotundifolium*, *Silene boryi*.
- 62.1123** **Valencian calcareous cliffs**
Jasion foliosae
Shady calcareous cliffs of Valencian mountains.
- 62.12** **CENTRAL PYRENEAN CALCAREOUS CLIFFS**
Saxifragion mediae
Calcareous cliffs of the central and eastern Pyrenees, with *Saxifraga media*, *S. longifolia*, *S. aretioides*, *Potentilla alchimilloides*, *P. nivalis*, *Ramonda myconi*, *Asperula hirta*.
- 62.13** **LIGURO-APENNINE CALCAREOUS CLIFFS**
Saxifragion lingulatae
Calcareous cliffs of the Maritime Alps and northern Apennines, with *Saxifraga lingulata*, *Primula marginata*, *P. allionii*, *Phyteuma charmelii*, *P. villarsii*, *Silene campanula*, *Potentilla saxifraga*, *Ballota frutescens*.
- 62.14** **SOUTHERN ITALIAN CALCAREOUS CLIFFS**
Dianthion rupicolae
Calcareous cliffs of southern Italy and Sicily, with *Dianthus rupicola*.
- 62.15** **ALPINE AND SUB-MEDITERRANEAN CALCAREOUS CLIFFS**
Potentilletalia caulescentis p.
Calcareous cliffs of the Alps, of lesser satellite ranges and of sub-Mediterranean areas of the northern Tyrrhenian periphery.
- 62.151** **Sunny Alpine calcareous cliffs**
Potentillion caulescentis
Well-lit calcareous cliffs of the Alpine system and neighbouring regions, including upper Provence, upper Languedoc, the pre-Pyrenees and Corbières, the Catalanian mountains, with *Potentilla caulescens*, *P. clusiana*, *P. nitida*, *Primula auricula*, *Hieracium humile*, *Cardaminopsis petraea*, *Androsace helvetica*, *Minuartia rupestris*.
- 62.152** **Middle-European calcareous fern cliffs**
Cystopteridion fragilis
Shady, cool, often moist rockfaces of the Alps and neighbouring regions, of the Jura, the Hercynian ranges, the British Isles, with many ferns, including *Cystopteris fragilis*, *C. regia*, *Asplenium viride*, *A. scolopendrium*, *A. trichomanes*, and with *Carex brachystachys*.

- 62.16** EU-MEDITERRANEAN GREEK CALCAREOUS CLIFFS
Campanulion versicoloris
Calcareous cliffs of the thermo- and meso-Mediterranean zones of mainland Greece, up to the *Abies cephalonica* belt, with *Campanula versicolor*, *C. rupestris*, *Sideritis roeseri*, *Stachys candida*, *Hypericum vesiculosum*, *Asperula arcadiensis*, *Galium boryanum*, *Centaurea pelia*, *Alkanna graeca*, *Alyssum orientale*, *Linaria microcalyx*, *Onosma frutescens*, *Inula candida*, *Centranthus ruber*, *Silene congesta*, *Teucrium flavum*.
- 62.17** AEGEAN CLIFFS
Cirsietalia chamaepeucis
Calcareous cliffs of the Aegean archipelagoes, one of the most diverse and endemic-rich groups of communities.
- 62.171** Cliffs of Crete
Petromarulion pinnatae
Cliffs and chasms of Crete, with *Petromarula pinnata*, *Galium fruticosum*, *Centaurea argentea*, *Ebenus cretica*, *Verbascum arcturus*, *Inula candida*, *Eryngium ternatum*, *Asperula incana*, *Dianthus juniperinus*, *Aster canus*, *Campanula pelviformis*, *C. saxatilis*.
- 62.172** Cliffs of Karpathos
Inulion heterolepis: Teucro-Inuletum
Cliffs of Karpathos, with *Teucrium heliotropifolium*, *Silene fruticosum*, *Galium incurvum*, *Inula heterolepis*.
- 62.173** Cliffs of the eastern Aegean
Inulion heterolepis: Campanulo-Inuletum
Cliffs of Rhodes, Samos, Icaria, Lesbos with *Campanula hagielia*, *Lactuca leburnea*, *Dianthus rhodensis*, *Inula heterolepis*, *Rosularia serrata*, *Sedum creticum*.
- 62.174** Cliffs of the Cyclades
Inulion heterolepis, Capparo-Amaracion
Cliffs of the Cyclades, with *Fibigia lunarioides*, *Eryngium amorginum*, *Amaracus tournefortii*, *Campanula amorgina*, *C. heterophylla*, *Helichrysum amorginum*.
- 62.175** Cliffs of the Northern Sporades
Capparo-Amaracion
Cliffs of the Sporades, with *Inula sophiae*, *Capparis spinosa*, *Dianthus arboreus*, *Amaracus tournefortii*.
- 62.18** SOUTHERN GREEK MONTANE CLIFFS
Silenion auriculatae
Calcareous cliffs of high altitudes of the Peloponnese, Giona and Parnassus, with *Silene auriculata*, *Achillea umbellata*, *Campanula rupicola*, *Saxifraga sibthorpii*, *S. marginata*, *S. spruneri*, *Minuartia stellata*, *Valeriana olenaea*, *Satureja parnassica*, *Rosa glutinosa*, *Viola poetica*, *Edraianthus parnassicus*, *Campanula aizoon*.
- 62.19** CENTRAL GREEK MONTANE CLIFFS
Calcareous cliffs of the high altitudes of the central and northern Pindus and of the Thessalian Olympus system.
- 62.191** Olympian cliffs
Saxifragion scardici
Cliffs of the Thessalian Olympus system, with *Saxifraga scardia*, *S. glabella*, *Campanula oreadum*, *Arabis bryoides*, *Potentilla deorum*, *Jankaea heldreichii*, *Omphalodes luciliae*.
- 62.192** Pindus calcareous cliffs
Galion degenii
Calcareous cliffs of the Pindus, with *Galium degenii*, *Edraianthus graminifolius*, *Asplenium fissum*, *Aubrieta gracilis*, *Achillea clavenae*, *Satureja parnassica*, *Hypericum apollinis*, *Gnaphalium roeseri*, *Trifolium noricum*, *Silene pindicola*.

62 Inland cliffs and exposed rocks

- 62.1A** NORTHERN GREEK CALCAREOUS CLIFFS
Ramondion nathaliae
Calcareous cliffs of the Vermion and other Greek ranges, with *Ramondia nathaliae*, *Campanula formanekiana*, *Alyssoides utriculata*, *Jurinea consanguinea*, *Micromeria cristata*.
- 62.1B** LOWLAND NORTHERN CALCAREOUS CLIFFS
Calcareous cliffs of the lowlands of northern and middle Europe colonized by communities referable to units other than 62; their nature can be specified by addition of the relevant codes.
- 62.2** VEGETATED SILICEOUS INLAND CLIFFS
Androsacetalia vandellii, *Asplenietalia lanceolato-obovati*, *Asplenietalia billotii*
Dry, siliceous inland cliffs and their communities. Specific plant associations colonize montane and Mediterranean cliffs. Most of the subdivisions below refer to them. Northern lowland cliffs usually support fragments of communities listed in other chapters.
- 62.21** MIDDLE EUROPEAN MONTANE SILICEOUS CLIFFS
Siliceous cliffs of the Alps, the Pyrenees and a few neighbouring ranges.
- 62.211** Pyreneo-Alpine siliceous cliffs
Androsacion vandellii p., *Saxifragion bryoidis*
Siliceous cliffs of the Alps and the Pyrenees, with *Androsace vandellii*, *Artemisia umbelliformis*, *Eritrichium nanum*, *Minuartia cherlerioides*, *Primula hirsuta*, *Phyteuma scheuchzeri*, *Erysimum rhaeticum*, *Saxifraga aspera*, *S. cotyledon*, *S. iratiana*, *S. retusa*, *S. bryoides*.
- 62.212** Hercynian siliceous cliffs
Androsacion vandellii p., *Asarinion procumbentis*
Siliceous cliffs of the Hercynian ranges and their periphery, of the British Isles and, locally, of the Jura, with *Saxifraga sponhemica*, *Biscutella laevigata*, *Asplenium septentrionale*, *A. adiantum-nigrum*, *A. billotii*, *A. foreziense*.
- 62.213** Hercynian serpentine cliffs
Asplenion serpentini
Serpentine cliffs of the Hercynian ranges and their periphery, with *Asplenium adulterinum*.
- 62.22** ORO-IBERIAN SILICEOUS CLIFFS
Siliceous cliffs of high altitudes of the Iberian mountains.
- 62.221** Ibero-Carpetanian siliceous cliffs
Saxifragion willkommianae
Siliceous cliffs of the Cordillera Cantabrica, the Iberian Range, the Cordillera Central and the Leonese mountains, with *Hieracium pallidum* ssp. *graniticum*, *Murbeckiella boryi* ssp. *boryi*, *M. boryi* ssp. *herminii*, *Saxifraga willkommiana*, *Spergula viscosa* ssp. *pouretii*.
- 62.222** Nevadan siliceous cliffs
Saxifragion nevadensis
Siliceous cliffs of the Sierra Nevada, with *Saxifraga nevadensis*, *Sedum brevifolium*, *Centranthus nevadensis*.
- 62.23** SOUTH-WESTERN ALPINE SILICEOUS CLIFFS
Saxifragion pedemontanae
Siliceous cliffs of the Maritime, Ligurian and Cottian Alps, with *Saxifraga pedemontana*.
- 62.24** CYRNO-SARDIAN MONTANE CLIFFS
Potentillion crassinerviae
Siliceous cliffs of the mountains of Corsica and Sardinia, with *Potentilla crassinervia*.
- 62.25** NORTHERN GREEK SILICEOUS CLIFFS
Silenion lerchenfeldianae
Siliceous cliffs of the mountains of northern Greece, with *Silene lerchenfeldiana*.

- 62.26** LANGUEDO-CATALAN SILICEOUS CLIFFS
Antirrhinion asarinae
Low altitude siliceous cliffs of the Cévennes and Catalan hills, with *Antirrhinum asarina*, *Sedum hirsutum*, *Centaurea pectinata*, *Sempervivum arvernense*, *Dianthus graniticus*, *Saxifraga clusii*, *S. hypnoides*.
- 62.27** WESTERN IBERIAN SILICEOUS CLIFFS
Cheilanthion hispanicae
Siliceous cliffs of the meso-Mediterranean level of western Iberia, with *Cheilanthus tinaei*.
- 62.28** PROVENÇO-IBERIAN SILICEOUS CLIFFS
Phagnalo-Cheilanthion fragrantis
Siliceous cliffs and rocks of low altitudes of Provence, Corsica and eastern Spain.
- 62.29** LOWLAND NORTHERN SILICEOUS CLIFFS
Siliceous cliffs of the hills of northern and middle Europe colonized by communities referable to units other than 62; their nature can be specified by addition of the relevant codes.
- 62.3** PAVEMENTS
Almost bare rock pavements and lapiaz. Cracks and superficially decomposed areas may be colonized by communities belonging, in particular, to the *Sedo-Scleranthion*, the *Alyss-Sc-dion albi* or the *Sedo albi-Veronicion dillenii* (34.11, 36.2).
- 62.4** BARE INLAND CLIFFS
Cliffs, in particular of very high altitudes, devoid of vascular vegetation. They are usually colonized by lichen crusts and 'ink stains'.
(Ellenberg, 1988)
- 62.41** LIMESTONE BARE INLAND CLIFFS
Protoblastenietea immersae i.a.
Rocks colonized by communities of internal crustose lichens (*Protoblastenia*, *Verrucaria*, *Petractis*, *Polyblastia*), external crustose lichens (*Caloplaca*, *Xanthoria*) or gelatinous (*Collema*) and foliose (*Dermatocarpon*) lichens.
- 62.42** SILICEOUS BARE INLAND CLIFFS
Rhizocarpetea geographici i.a.
Rocks colonized by communities of external crustose lichens (*Rhizocarpon*), navel lichens (*Umbilicaria*) and fruticose lichens (*Ramalina*, *Cornicularia*, *Rhizoplaca*).
- 62.5** WET INLAND CLIFFS
Very wet, dripping, overhanging or vertical rocks of hills, mountains and Mediterranean lowlands.
- 62.51** MEDITERRANEAN WET INLAND CLIFFS
Adiantetalia
Wet inland cliffs of Mediterranean regions, with a specialized vegetation formed by *Adiantum capillus-veneris*, mosses, *Borago pygmaea*, *Pinguicula grandiflora* ssp. *coenocantabrica*.
(Guinochet and Vilmorin, 1976; Molinier and Martin, 1980; Rivas-Martinez, Diaz *et al.*, 1984; Lahondère *et al.*, 1985)
- 62.52** NORTHERN WET INLAND CLIFFS
Wet inland cliffs of middle European hills and mountains. They are often colonized by unique plant assemblages, the components of which are, however, equally characteristic of other habitats; notable among such species are *Saxifraga paniculata*, *Alchemilla glabra*, *Viola palustris*, *Phegopteris connectilis*.
- 62.6** MACARONESIAN INLAND CLIFFS
Aeonio-Greenovietae
Inland cliffs of the Canary Islands, Madeira and the Açores, extremely rich in endemic species of both plants and animals, including vertebrates (the endangered *Pterodroma madeira*). The genus *Aeonium* is particularly representative.

63 Eternal snow and ice

High mountain zones occupied by glaciers or by perennial snow. They are inhabited by algae (e.g. *Chlamydomonas nivalis*) and invertebrates.
(Ellenberg, 1988)

63.1

SNOW PACKS

Quasi-permanent snow packs, in particular in avalanche corridors.

63.2

ROCK GLACIERS

63.3

TRUE GLACIERS

64 Inland sand-dunes

Sand bodies of eolian origin, possessing constructional relief and separated from the coast and its dune cordons by non-dunal habitats. They support a vegetation which differs markedly from coastal sand-dune communities.

(Ellenberg, 1963, 1988; Flint, 1971)

- 64.1 FLUVIO-GLACIAL DUNES**
Dunes of the North Sea and Baltic plains, formed of quartzic sands originating in redeposited and reworked glacial drift and outwash. These highly siliceous dunes are characteristic of The Netherlands, northern Belgium and northern Germany. The dune systems, particularly the large ones, harbour a unique ensemble of interacting communities and harbour many specialized and restricted organisms. They have considerably regressed and the remaining examples are fragile and often threatened. The presence of the various elements of the ecosystem can be indicated by simultaneous use of the codes below and of those relevant to the types of plant communities they represent.
(Traets, 1956; Flint, 1971; Westhoff and den Held, 1975; De Smidt, 1981; Fuller, 1982; Nordiska ministerradet, 1984; Drachenfels *et al.*, 1984; Van Dijk *et al.*, 1984; Webb, 1986; Dijkhuizen and Tuttel, 1987; Ellenberg, 1988; Oberdorfer, 1990)
- 64.11 INLAND DUNE PIONEER GRASSLANDS**
Corynephorion canescentis
Formations of inland sands with *Corynephorus canescens*, *Carex arenaria*, *Spergula morisonii*, *Teesdalia nudicaulis* and carpets of fruticose lichens (*Cladonia*, *Cetraria*) (see 35.23).
- 64.12 INLAND DUNE SILICEOUS GRASSLANDS**
Other grasslands of inland dune systems with *Agrostis spp.* and *Corynephorus canescens* or other acidophilous grasses; their composition can be specified by use of codes of 35 other than 35.23.
- 64.13 INLAND DUNE HEATHS**
Genistion pilosae p.
Heaths colonizing inland dunes.
- 64.131 Drente crowberry heaths**
Heaths of the relict wandering dunes of Drente and southern Friesland, with *Empetrum nigrum*, *Salix arenaria*, *Lophocolea cuspidata*, *Pseudoscleropodium purum*, *Hylocomium splendens*.
- 64.132 Other inland dune heaths**
Other heaths colonizing inland dunes; their composition can be specified by use of codes of 31.22.
- 64.14 INLAND DUNE THICKETS**
Formations of large shrubs colonizing inland dunes.
- 64.141 Inland dune juniper scrubs**
Juniperus communis-rich scrubs of inland dunes.
- 64.142 Other inland dune thickets**
Thickets other than juniper scrubs in inland dune systems; their composition can be specified by use of codes of 31.8.
- 64.15 INLAND DUNE WOODS**
Natural woods, usually birch-oak or, east of the Elbe, *Pinus sylvestris*, installed within inland dune systems. Their composition can be specified by use of codes of 41 or 42.

64 Inland sand-dunes

- 64.16** **NORTHERN RIVER DUNES**
Formations in the immediate vicinity of great rivers within the North Sea-Baltic plain, comprising, besides the communities of 64.11 to 64.15, slightly calcareous grasslands of 34.12 and 34.34.
- 64.2** **BRECKLAND INLAND DUNES**
Remnants of the once vast Breckland inland dune system, of similar glacial origin to that of the continental fluvio-glacial dunes of 64.1, and like them, colonized by acidophilous grasslands and heaths.
(Fuller, 1982; Webb, 1986)
- 64.3** **PALAEO-COASTAL DUNES**
Dune cordons marking former, though post-glacial, seashores. They are strongly decalcified and the communities that occupy them are similar to those of continental dunes, though floristically more influenced by the proximity of the sea, and often related to the decalcified inner fringes of the coastal dunes. Subhabitats may be indicated by use of the same codes as in 64.1 (replacing the prefix 64.1 by 64.3), specified by those of 35.2, 31.2, 31.8, 41, 42 or 16.2.
- 64.4** **FLUVIATILE DUNES**
Dunes of the great rivers of middle Europe (Seine, Loire, Saône, Rhine). Like the fluvio-glacial dunes of northern Europe, they carry specialized and rare ecosystems. They are much more calcareous than the northern inland dunes and their grasslands (34.12, 34.34 *i.a*) have a sub-steppic character contrasting with that of neighbouring regions. They are highly vulnerable. A small remnant exists in the Po plain of northern Italy.
(Groppali *et al.*, 1980; Géhu, 1985; Ellenberg, 1988)
- 64.5** **LACUSTRINE DUNES**
Unique dunes of the Savoie shore of Lake Geneva (Excenevex).
(Ozenda, 1982; Géhu, 1985)
- 64.6** **MEDITERRANEAN INLAND DUNES**
Inland dunes of Mediterranean climates.
- 64.61** **RHÔNE RIVERINE DUNES**
Fossil dunes of the Camargue, built up by silty alluvial sands of the Rhône.
(Molinier and Tallon, 1970; Molinier and Martin, 1982)
- 64.611** **Rhône dune grasslands**
- 64.6111** **Rhône dune cane beds**
Imperata cylindrica and *Saccharum ravennae* of the Camargue.
- 64.6112** **Other Rhône dune grasslands**
Dry grasslands of the *Malcomietalia* (35.4), *Thero-Brachypodietea* (34.5), *Brachypodietalia phoenicoidis* (34.36) colonizing inland Camargue dunes.
- 64.612** **Rhône dune scrubs**
Mediterranean scrubs of the Camargue inland dunes (32).
- 64.613** **Rhône dune juniper woodland**
Juniperus phoenicea ssp. *lycia* woodland of the bois des Rièges in the Camargue.
- 64.62** **SOUTHERN IBERIAN INLAND DUNES**
Fossil dunes of the Coto Doñana and other areas of south-western Iberia. They support very specialized brushes (32.2A) and open grasslands belonging to the *Malcomietalia* (35.4, 16.228).
(Rivas-Martinez *et al.*, 1980)

65 Caves

Any natural caves or cave systems. They harbour varied communities of animals that are strictly restricted to them. A classification of caves based on the presence of these communities should be used to subdivide this unit. Provisionally, the following, containing unique endemic vertebrates must, at the very least, be distinguished.

- 65.1 ITALIAN CAVES WITH *PROTEUS ANGUINUS*
- 65.2 NORTHERN ITALIAN AND SOUTH-EASTERN FRENCH CAVES WITH *HYDROMANTES ITALICUS*
- 65.3 SARDINIAN CAVES WITH *HYDROMANTES GENEI*
- 65.4 OTHER CAVES



66 Volcanic features

Sites and products of recent volcanic activity harbouring distinct biological communities.

- 66.1 TEIDE VIOLET COMMUNITY**
Violetea cheiranthifoliae
 Very open formation of the summit of the Teide volcano of Tenerife, above (2 700) 3 000 m, with *Viola cheiranthifolia* and a few individuals of *Silene nocteolens* and *Argyranthemum teneriffae*.
 (Wildpret de la Torre and del Arco Aguilar, 1987; Serrada *et al.*, 1988)
- 66.2 ETNA SUMMITAL COMMUNITIES**
 Communities of Mount Etna, above the limit of hedgehog-heaths.
- 66.3 BARREN LAVA FIELDS**
 Almost bare lava formations of other volcanoes, and of lower altitudes on Etna and Teide, colonized by, besides communities related to ones covered in other sections, lichens (e.g. *Stereocaulon vesubianum*) and invertebrates.
 (Serrada *et al.*, 1988; Machado *in litt.*, 1989)
- 66.4 VOLCANIC ASH AND LAPILLI FIELDS**
- 66.5 LAVA TUBES**
 Caves formed by hollow basaltic tubes resulting from the cooling of the surface of lava flows whose molten interior continued to flow. The very large tube created by the volcano La Corona of Lanzarote harbours unique communities of invertebrates, in particular, the decapode crustacean *Munidopsis polymorpha*, endemic to that locality, and several crustaceans of the genus *Speleonectes*.
 (Serrada *et al.*, 1988; Machado *in litt.*, 1989)
- 66.6 FUMAROLES**
 Orifices in volcanic areas through which escape hot gases and vapours. Their very extreme environment is colonized by paucispecific but highly distinct communities.
 (Brullo *et al.*, 1977; Wildpret de la Torre and del Arco Aguilar, 1987)
- 66.61 ITALIAN FUMAROLES**
 Fumaroles of the Italian peninsula and its small islands, in particular those of Isola d'Ischia, with communities that include *Cyperus polystachyos*.
- 66.62 ETNA FUMAROLES**
 Fumaroles of Mount Etna.
- 66.63 PANTELLERIA FUMAROLES**
Radiolo-Kickxietum cirrhosae
 Fumaroles of Pantelleria. Their walls, mouth and immediate vicinity are colonized by a succession of microvegetation composed of bryophytes, ferns and a few angiosperms. Constituting plants include the endemic moss *Calymperes sommieri*, sole Mediterranean representative of a tropical genus, as well as *Radiola linoides*, *Kickxia cirrhosa*, *Trifolium angustifolium*, *Centaurium maritimum*.
- 66.64 CANARIAN FUMAROLES**
 Fumaroles of the Canary Islands with, in particular, the endemic *Gnaphalium teydeum*.