OV37
Festuca ovina-Minuartia verna community
Minuartio-Thlaspietum alpestris Koch 1932

Constant species
Agrostis capillaris, *Campanula rotundifolia*, *Festuca ovina*, *Minuartia verna*, *Thymus praecox*.

Physiognomy
The *Minuartio-Thlaspietum alpestris* characteristically comprises an open turf in which tussocks of *Festuca ovina*, patches of *Agrostis capillaris* and scattered individuals or populations of *Minuartia verna* are the most prominent feature. *Thymus praecox* is also constant and its mats can be locally quite extensive and there is very often a little *Campanula rotundifolia* and *Rumex acetosella*. Among the more frequent associates of the community, *Thlaspi alpestre* is the most distinctive, though it is typically not abundant.

Other species recorded commonly throughout, though not usually in any abundance, are *Rumex acetosa*, *Senecio jacobaea*, *Linum catharticum* and, particularly in transitions to more continuous calcicolous and mesotrophic swards, *Lotus corniculatus* and *Trifolium repens*. Occasionals of the community include *Geranium robertianum*, *Cerastium fontanum*, *Hieracium pilosella*, *Cirsium vulgare*, *Agrostis stolonifera* and *Viola lutea*.

Through the community as a whole, bryophytes are neither numerous nor extensive, though small patches of *Pohlia nutans*, *Weissia controversa* and *Dicranum scoparium* can sometimes be seen. Lichens, too, are absent from many stands but strikingly varied and abundant in one sub-community.

Sub-communities

Typical sub-community: *Minuartio-Thlaspietum typicum* Shimwell 1968*a*. In this vegetation, *Minuartia verna*, *Festuca ovina* (here occasionally joined by *F. rubra*) and *Agrostis capillaris* dominate the sward with a typical range of community associates. In stands from the Yorkshire Dales, *Galium sterneri* is a distinctive associate.

***Achillea millefolium-Euphrasia officinalis* sub-community:** *Minuartio-Thlaspietum achilletosum* Shimwell 1968*a*. The cover of the turf in this sub-community is somewhat more extensive than usual and, among the grasses, *Anthoxanthum odoratum* and, less commonly, *Koeleria macrantha* and *Avenula pratensis* join *F. ovina* and *Agrostis capillaris*. Usually more obvious, though, is the increased frequency of *Trifolium repens*, *Lotus corniculatus* and *Linum catharticum* and, especially diagnostic, of *Achillea millefolium*, *Euphrasia officinalis* agg. and *Plantago lanceolata*. *Anthyllis vulneraria* and *Carex flacca* are also preferential at low frequencies. Among bryophytes, *Rhytidiadelphus squarrosus* is very common, though not usually abundant.

***Cladonia* spp. sub-community:** *Minuartio-Thlaspietum cladonietosum* Shimwell 1968*a*. The vascular contingent here is less extensive than in other types of *Minuartio-Thlaspietum* and there are no distinctive preferentials among them apart from occasional scattered sprigs of *Calluna vulgaris*. Lichens, however, are unusually prominent and sometimes diverse. Most common and abundant among them are *Cladonia rangiformis*, *C. chlorophaea* and *Cornicularia aculeata* with *Cladonia pyxidata*, *C. impexa*, *C. gracilis*, *C. arbuscula* and *C. furcata* less frequent and extensive. *Bryum pallens* is an occasional preferential but bryophytes are generally not important in the sward.

Habitat
The *Minuartio-Thlaspietum* is a local community restricted to the spoil heaps of lead mines or outcrops of veins of heavy metals among calcareous bedrocks around the upland fringes of northern and western Britain. It is usually open to grazing stock but the composition and structure of the vegetation are strongly influenced by the mineralogy of the soil parent material.

Lead-bearing mineral veins are especially associated in Britain with the Carboniferous Limestone deposits of the Mendips, Derbyshire Dales, Yorkshire Dales and

north Pennines, and have been exploited in these areas since Roman times. More recent mining activities, particularly from the last century, have left extensive areas of spoil in particular localities in these regions and their mixture of limestone and shale fragments and minerals such as fluorspar and barytes, forms a distinctive soil parent material.

Although data were not available for this survey, vegetation with marked floristic and physiognomic affinities to the *Minuartio-Thlaspietum* is also to be found in a few places on stable river gravels rich in heavy metals in a number of river valleys in northern England, most notably the South Tyne, where washings from mineral processing in the catchments have been redeposited (Sellars & Baker 1988). Serpentine rocks rich in nickel, chromium and cobalt can also support vegetation with close affinities to the *Minuartio-Thlaspietum* in Scotland (Birse 1982).

The community can be found down to altitudes of 150 m, but it is mostly characteristic of somewhat higher ground, extending up to 730 m, and generally the sites experience the more or less cool and wet climate characteristic of the British uplands. Annual precipitation is usually over 1000 mm, up to 2500 mm in the north Pennines, and the mean annual maximum temperature is less than 26 °C (*Climatological Atlas* 1952). Under such circumstances, especially with such a parent material, the development of soil is slow and, particularly on the looser spoil, there is no real profile, simply pockets of gradually weathering mineral debris with local accumulation of humus from decaying vegetation.

Most important in limiting colonisation, however, are the large amounts of heavy metals present in the spoil. Among these, it is not lead, the prize of the mining enterprise, but zinc which if of greatest impact. Ernst (1965) reported zinc contents up to 5060 ppm in soils of such mire spoil near Osnabrück in Germany and concentrations of 2460 and 6790 ppm in the leaves of *Minuartia verna* and *Thlaspi alpestre*. These two species, the most distinctive associates of the community, can accumulate zinc and other plants, like *Festuca ovina* (Ellenberg 1988), *Agrostis capillaris* (Bradshaw 1952) and probably also *Rumex acetosa*, have strains tolerant of heavy metals. For other species, unable to tolerate or reduce such potential toxins, the spoil-heaps provide an extreme environment that can be colonised only where earlier invaders have reduced the levels or where the debris has been intermixed with other adjacent parent material, like head or alluvium at the foot of slopes or along streamsides.

Among the sub-communities, the typical form of the *Minuartio-Thlaspietum* is found on spoil with more immature soils while the *Achillea-Euphrasia* sub-community occurs on more stable material with better-developed profiles and in transitions to rendzinas and brown calcareous earths on less contaminated ground around the spoil. The main floristic differences between these vegetations types, with an increase in more mesophytic and less zinc-tolerant plants reflects this edaphic shift, though the swards of the *Achillea-Euphrasia* sub-community also tend to be more influenced by grazing as they provide more accessible and palatable herbage.

The distinctive features of the *Cladonia* sub-community reflect the more extreme climatic conditions found at higher altitudes. Stands usually occur between 400 and 600 m in cold and windy situations where the rainfall is considerably higher. Leaching of the surface of the detritus is more obvous than in the drier climate at lower altitudes and, with scattered plants of *Calluna* among the patchy *Cladonia* carpet, the vegetation has something of the appearance of a lichen heath. The maintenance of a lichen carpet is probably also dependent on freedom from trampling by grazing stock.

Zonation and succession

The usual context of the *Minuartio-Thlaspietum* is among grasslands and heaths, any transitions to which are mediated by differences in soils.

In fact, quite often, stands of the community are rather sharply marked off from the grasslands around. At lower altitudes, in the Mendips and Derbyshire, these grasslands are usually of the *Festuca-Avenula* type, most often the *Dicranum* sub-community or, where there has been some improvement for agriculture, the *Holcus-Trifolium* sub-community. Where soils change more gradually, Typical *Minuartio-Thlaspietum* may give way to the Mesobromion pastures through the *Achillea-Euphrasia* sub-community. In other places, the latter vegetation passes to a Cynosurion sward, usually the *Lolio-Cynosuretum*, derived by fertilising and often ploughing and reseeding. Where soils are somewhat less calcareous, as where superficials overlie the limestone, the *Festuca-Agrostis-Galium* grassland can figure among the pastures around the lead-mine spoil or, where grazing has not been so heavy, heath vegetation. In the Mendips, where this situation is more common, this is generally *Calluna-Ulex gallii* heath.

At higher altitudes over most of the Yorkshire Dales, the calcicolous pasture is of the *Sesleria-Galium* type. The Typical sub-community of this grassland can pass sharply to Typical *Minuartio-Thlaspietum* or the *Cladonia* sub-community or, more gradually, through the *Achillea-Euphrasia* sub-community. Elsewhere, on somewhat more acidic soils, the *Sesleria-Galium* grassland can be replaced by the *Festuca-Agrostis-Thymus* grassland or, where grazing has not been so intensive, by grassy forms of *Calluna-Vaccinium* heath.

Where succession has proceeded further around old lead mines, the *Minuartio-Thlaspietum* may be closely hemmed in by *Crataegus-Hedera* scrub and *Fraxinus-Acer-Mercurialis* woodland at lower altitudes or by

Fraxinus-Sorbus-Mercurialis on higher ground to the north. The character of the soils supporting the *Minuartio-Thlaspietum* itself is generally inimical to colonisation by shrubs and trees, but relief from grazing may have some effect on the vegetation in the long term.

Distribution

The community occurs locally in the Mendips, Derbyshire Dales, Yorkshire Dales and north Pennines.

Affinities

First described formally from Britain by Shimwell (1968*a*), this vegetation is clearly synonymous with the *Minuartio-Thlaspeetum* Koch 1932, the core association of the western European vegetation of heavy-metal habitats placed in the alliance Thlaspion calaminaris Ernst 1964. The association has also been described from Germany (Pott 1992) and from Ireland (Doyle 1982, White & Doyle 1982). Following Braun-Blanquet & Tüxen (1943), heavy metal vegetation was placed in a separate class, the Violetea calaminariae (e.g. Westhoff & den Held 1969, White & Doyle 1982) but the favoured view now is that these assemblages should return to their original location in the Festuco-Brometea. Certainly, among British stands of this type, there is a strong similarity to the *Festuca-Hieracium-Thymus* grassland, a Continental sward of rendzina soils which belongs to the Koelerio-Phleion. In his survey of Scottish vegetation, Birse (1980, 1984) described several associations from serpentine soils which he placed in the Violetea but further data are required to clarify the relationship of the various assemblages.

Floristic table OV37

	a	b	c	37
Festuca ovina	V (2–9)	V (1–6)	V (1–8)	V (1–9)
Minuartia verna	V (2–7)	V (1–6)	V (1–6)	V (1–7)
Campanula rotundifolia	IV (1–4)	IV (1–3)	IV (1–3)	IV (1–3)
Thymus praecox	IV (1–5)	IV (1–4)	III (1–3)	IV (1–5)
Agrostis capillaris	III (1–6)	IV (1–3)	IV (1–4)	IV (1–6)
Festuca rubra	II (2–7)		I (1)	I (1–7)
Galium sterneri	II (1–6)		I (5)	I (1–6)
Weissia controversa	II (1–2)		I (1)	I (1–2)
Linum catharticum	III (1–3)	IV (1–3)	III (1–3)	III (1–3)
Trifolium repens	II (1–3)	IV (1–3)	III (1–3)	III (1–3)
Lotus corniculatus	II (2–6)	IV (1–3)	III (1–3)	III (1–3)
Achillea millefolium	I (1)	V (1–3)		III (1–3)
Euphrasia officinalis agg.	I (1)	V (1–3)	I (1)	III (1–3)
Anthoxanthum odoratum	I (1)	IV (1–4)		II (1–4)
Plantago lanceolata		IV (1–3)		II (1–4)
Rhytidiadelphus squarrosus	I (2)	IV (1–4)		II (1–4)
Dicranum scoparium	I (3)	II (1–3)	I (1)	I (1–3)
Koeleria macrantha	I (2)	II (1–3)	I (1)	I (1–3)
Anthyllis vulneraria		II (1–4)		I (1–4)
Avenula pratensis		II (1–3)		I (1–3)
Carex flacca		II (1–3)		I (1–3)
Cladonia rangiformis		I (1)	IV (1–4)	III (1–4)
Cladonia chlorophaea			IV (1–4)	II (1–4)
Cornicularia aculeata			IV (1–2)	II (1–2)
Cladonia pyxidata	I (1)		IV (1–3)	II (1–3)
Calluna vulgaris			III (1–3)	II (1–3)
Cladonia impexa	I (1)		II (3–4)	I (1–4)
Bryum pallens	I (1)		II (1–3)	I (1–3)
Cladonia gracilis			II (2–4)	I (2–4)

Cladonia furcata			I (2)	I (2)
Cladonia arbuscula			I (3)	I (3)
Rumex acetosa	III (1–6)	IV (1–3)	III (1–4)	III (1–6)
Thlaspi alpestre	III (1–4)	III (1–3)	III (1–3)	III (1–4)
Senecio jacobaea	II (1–2)	III (1–3)	II (1–3)	II (1–3)
Geranium robertianum	II (1–3)	II (1–3)	II (1–3)	II (1–3)
Cerastium fontanum	II (1–2)	II (1–3)		II (1–3)
Cirsium vulgare	II (1–3)	II (1–3)	I (1)	II (1–3)
Hieracium pilosella	II (2)	II (1–4)		II (1–4)
Agrostis stolonifera	II (1–3)	I (1)	II (1–3)	II (1–3)
Viola lutea	II (1–4)	I (1)	II (1)	II (1–4)
Galium saxatile	I (1)	I (1)	I (1)	I (1)
Arrhenatherum elatius	I (1)	I (1)	I (1)	I (1)
Dactylis glomerata	I (1)	I (1)		I (1)
Pohlia nutans		I (1)	I (1–3)	I (1–3)
Carex caryophyllea	I (1–2)		I (1)	I (1–2)
Parmelia saxatilis	I (1)		I (1)	I (1)
Number of samples	15	10	13	38
Number of species/sample	14 (9–19)	23 (15–29)	16 (11–27)	16 (9–29)
Herb cover (%)	60 (40–80)	88 (70–100)	51 (40–70)	69 (40–100)
Bryophyte/lichen cover (%)	2 (0–5)	11 (5–25)	56 (30–80)	22 (0–80)

a Typical sub-community
b *Achillea millefolium-Euphrasia officinalis* agg. sub-community
c *Cladonia* spp. sub-community
37 *Minuartio-Thlaspietum alpestris* (total)

https://doi.org/10.1017/CBO9780511541834.106 Published online by Cambridge University Press