ORE DEPOSITIONAL PROCESSES IN THE FORMATION OF THE NAVAN ZINC/LEAD DEPOSIT, CO. MEATH, IRELAND.

IAIN KERR ANDERSON

A THESIS SUBMITTED FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

STRATHCLYDE UNIVERSITY, GLASGOW
DEPT. OF APPLIED GEOLOGY
1990

VOLUME III PLATES

LIST OF PLATES

CHAPTER 3

CHAPTER 4

CHAPTER 5

Plate 5.6b Granular sphalerite overprinting replaced allochems in 2-2 Lens.

Plate 5.7 Sulphides infilling small, bedding-parallel cavites in a hand specimen from 2-1 Lens.

Plate 5.8 Galena cubes within a small, bedding-parallel cavity in 2-3 Lens.

Plate 5.9 Collapsed clasts of sphaleritized allochems from 2-3 Lens.

Plate 5.10 Bedding-parallel sulphide stringers in 2-4 Lens.

Plate 5.11a Sulphide stringer in thin section.

Plate 5.11b Close-up of Plate 5.11a.

Plate 5.11c Sphalerite inclusions in dolomite from 2-4 Lens.

Plate 5.12 Disrupted sphalerite clasts in 2-4 Lens.

Plate 5.13a Contorted coarse galena in 2-2 Lens.

Plate 5.13b Layered coarse galena in 2-2 Lens.

Plate 5.14 Ghost oolitic structures in barite in 2-2 Lens.

Plate 5.15 Coarse bladed galena from 2-1 Lens.

Plate 5.16a Granular and zoned sphalerite crystals in 2-2 Lens.

Plate 5.16b Zoned sphalerite crystal from 2-2 Lens.

Plate 5.16c Zoned sphalerite crystals and coarse galena in 2-5 Lens.

Plate 5.16d Halo developed within sphalerite in 2-2 Lens.

Plate 5.16e Galena/sphalerite layers in 2-2 Lens.

Plate 5.17 Zoned sphalerite crystals and a crustiform sphalerite growth in 2-2 Lens.

Plate 5.18a Crustiform sphalerite from 2-2 Lens.

Plate 5.18b Rhythmically banded sphalerite from 2-5 Lens.

Plate 5.18c Dissolution within rhythmically banded sphalerite from 2-2 Lens.

Plate 5.19 Late-stage pyrite in 2-2 Lens.

Plate 5.20 Carbonate "dyke" within sulphides in 2-2 Lens.

Plate 5.21a Deformed pressure solution seam in the Nodular Marker.

Plate 5.21b Close-up of Plate 5.21a.

Plate 5.22 Brecciation of bladed galena from 2-2 Lens.

Plate 5.23a Funnel structure in 2-2 Lens.

Plate 5.23b Funnel structure in 2-2 Lens.

Plate 5.24a Ore horizon in 2-1 Lens.

Plate 5.24b Mineralization in 2-1 Lens at the contact between a bioclastic calcarenite and an overlying dolomite.

Plate 5.25 Argillite and sphalerite layers at the base of a sulphide horizon in 2-1 Lens.

Plate 5.26 Dissolutional contact between argillite and an underlying calcarenite in 2-3 Lens.

Plate 5.27a Internal sphalerite sediment in 2-3 Lens.

Plate 5.27b Internal sphalerite sediment in 2-4 Lens.

Plate 5.27c Graded, internal sphalerite sediment in drillcore from 1-5 Lens.

Plate 5.28a Internal sphalerite sediment from 2-1 Lens.

Plate 5.28b Layered sphalerite from 2-4 Lens.

Plate 5.28c Disrupted/slumped sphalerite layers in drillcore from 2-3 Lens.

Plate 5.29 Detrital quartz-rich layers by sphalerite in 2-3 Lens.

Plate 5.30 Porphyroblastic galena growth from 2-2 Lens.

Plate 5.31a Complex assemblage of sulphide clasts in 2-1 Lens.

Plate 5.31b Complex assemblage of sulphide clasts in drillcore from 2-1 Lens.

Plate 5.32 <u>In-situ</u> sulphide growths in 1-5 Lens.

Plate 5.33a Dendritic galena from 1-5 Lens.

Plate 5.33b Skeletal galena crystals from 2-4 Lens.

Plate 5.33c Skeletal galena crystals from 2-4 Lens.

Plate 5.34a "Stalactitic" pyrite growths from 1-5 Lens.

Plate 5.34b "Stalactitic" growths in 2-3 Lens.

Plate 5.35 "Stalactitic" pyrite from 1-5 Lens.

Plate 5.36a Rhythmically banded sphalerite in 1-5 Lens.

Plate 5.36b Rhythmically banded or colloform sphalerite overgrowths on skeletal galena in 2-3 Lens.

Plate 5.36c Colloform sphalerite overgrowths from 2-4 Lens.

Plate 5.37a Geopetal sphalerite sediment from 2-3 Lens.

Plate 5.37b Geopetal sphalerite sediment from 2-4 Lens.

Plate 5.38a Geopetal sphalerite sediment from 2-2 Lens.

Plate 5.38b Geopetal sphalerite sediment from 2-3 Lens.

Plate 5.38c Geopetal sphalerite sediment from 2-1 Lens.

Plate 5.39a Rhythmically banded sphalerite from 2-3 Lens.

Plate 5.39b Honeyblende sphalerite from 2-4 Lens.

Plate 5.40 Honeyblende sphalerite from 2-3 Lens.

Plate 5.41 Late-stage barite from 1-5 Lens.

Plate 5.42a Sphalerite inclusions within late-stage calcite in 1-5 Lens.

Plate 5.42b Sphalerite inclusions within late-stage calcite in 1-5 Lens.

Plate 5.43 Sulphides at the contact between micrite and an overlying dolomite in 1-5 Lens.

Plate 5.44 Brecciated micrite above sulphides in 1-5 Lens.

Plate 5.45 Massive sulphides at the contact between micrite and overlying pale dolomite in 1-5 Lens.

Plate 5.46 Chaotic clasts of sulphide from 1-5 Lens.

Plate 5.47 Chaotic clasts of sulphide from 1-5 Lens.

Plate 5.48 Late-stage pyrite in 1-5 Lens.

Plate 5.49 Concretionary sulphide growth from 1-5 Lens.

Plate 5.50 Sulphides in drillcore from 1-5 Lens.

Plate 5.51 Disrupted clasts of sulphide from 1-5 Lens.

Plate 5.52 Green shale band as a local barrier to sulphides in 2-5 Lens.

Plate 5.53 High-grade massive sulphides in 2-5 Lens.

Plate 5.54 Poorly zoned sphalerite from 2-5 Lens.

Plate 5.55 Pyrite replacing allochems in 2-5 Lens.

Plate 5.56 Sphalerite replacing host rock in 2-5 Lens.

Plate 5.57 Bladed galena from 2-5 Lens.

Plate 5.58a Sphalerite from 2-5 Lens under transmitted light.

Plate 5.58b Plate 5.58a under cathodoluminescence.

Plate 5.59a Sphalerite and dolomite from 2-5 Lens under transmitted light.

Plate 5.59b Plate 5.59a under cathodoluminescence.

Plate 5.60 Narrow sulphide vein in 2-5 Lens.

Plate 5.61 Cathodoluminescent light photograph illustrating small geopetal sphalerite sediments and rhythmically banded sphalerite from 2-5 Lens.

Plate 5.62 Disrupted sphalerite geopetal from 2-5 Lens.

Plate 5.63 Dissolution of the coarse, poorly zoned sphalerite from 2-5 Lens.

Plate 3.1 Photograph of drillcore illustrating the CG unit of the Laminated Beds exhibiting cross-bedding in a thin, pale brown sandstone, laminated sands and muds, and an erosional/ slump surface within the sands and muds. Way-up is to the left.

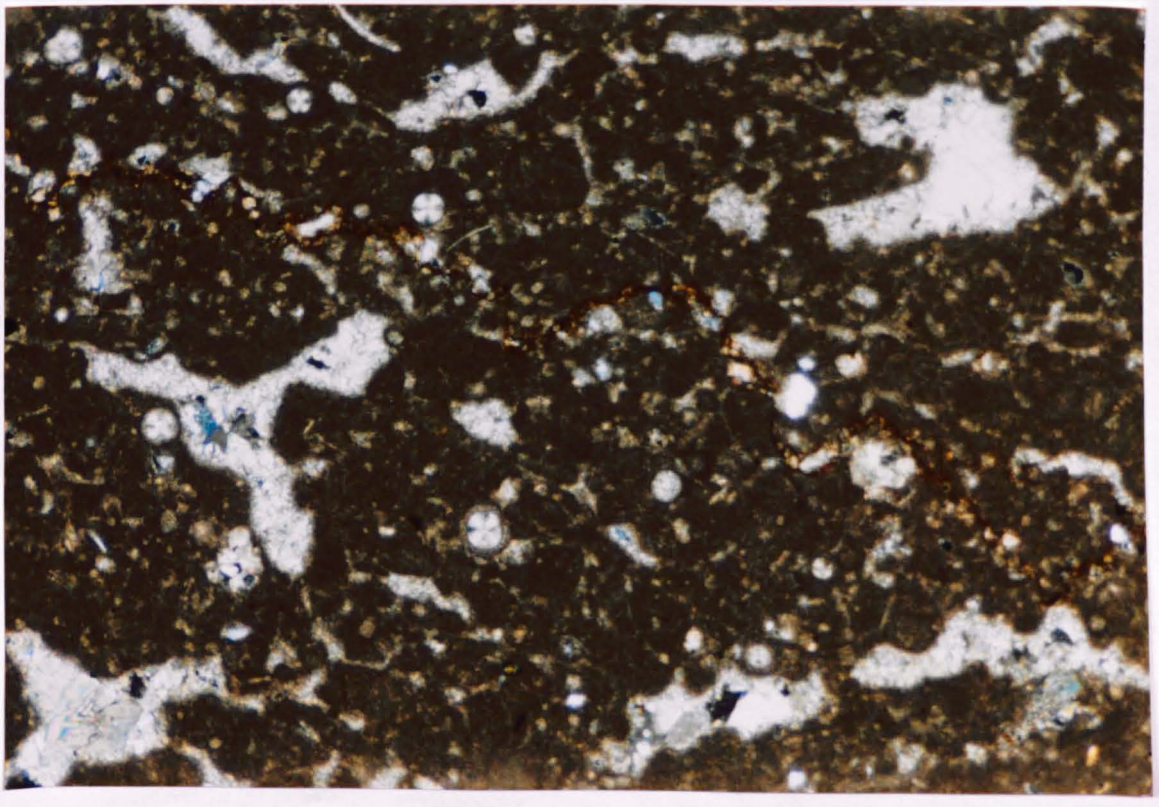
Plate 3.2 Photograph of drillcore illustrating thick microconglomerates in the Muddy Limestones in the western mine area. Way-up is to the left.


dessin · marquage · écriture
marcar · rotular · diseñar


dessin · marquage · écriture
marcar · rotular · diseñar

Plate 3.3 Photograph of drillcore illustrating micrites in the 5 Lens interval from the western mine area exhibiting well-developed birdseyes. Way-up is to the left.

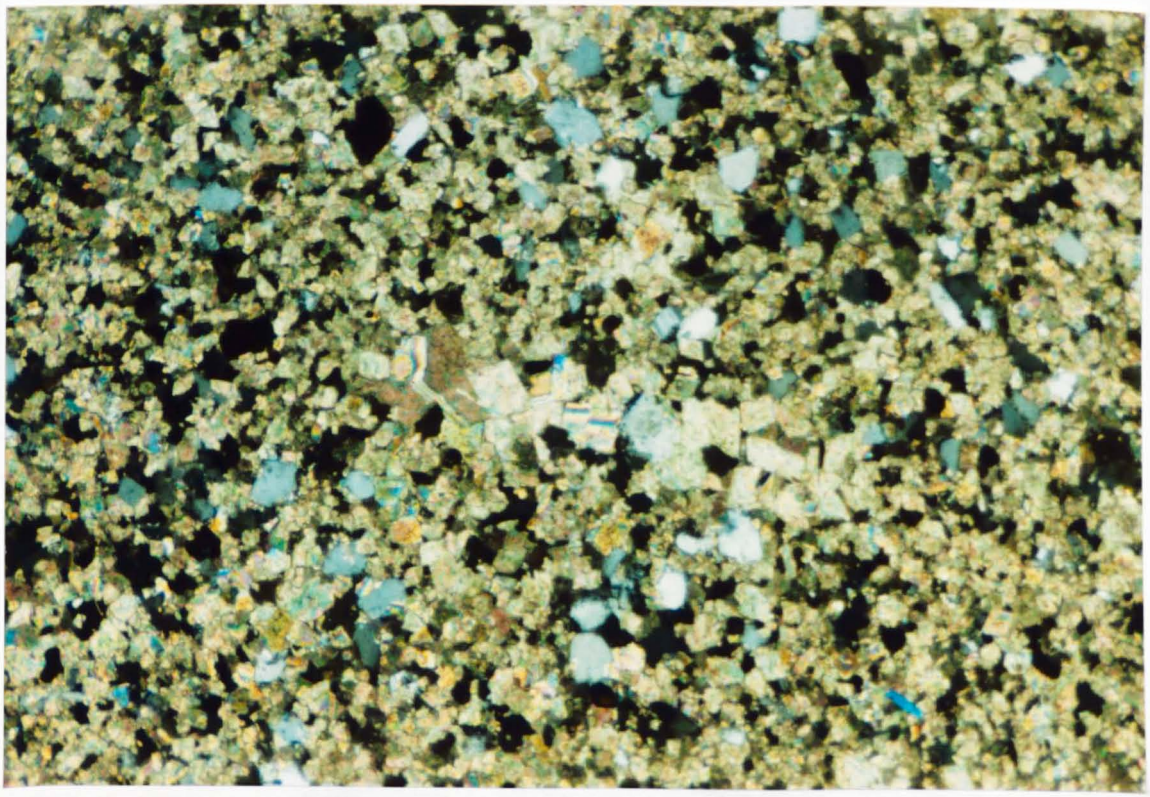
Plate 3.4 Transmitted light photograph (x-polars) of micrites illustrating fenestral porosity and calcispheres.



0.5mm

Plate 3.5 Photograph of drillcore illustrating the main dolomite horizon (pale/buff coloured) in the 5 Lens interval in the western mine area. Way-up is to the left.

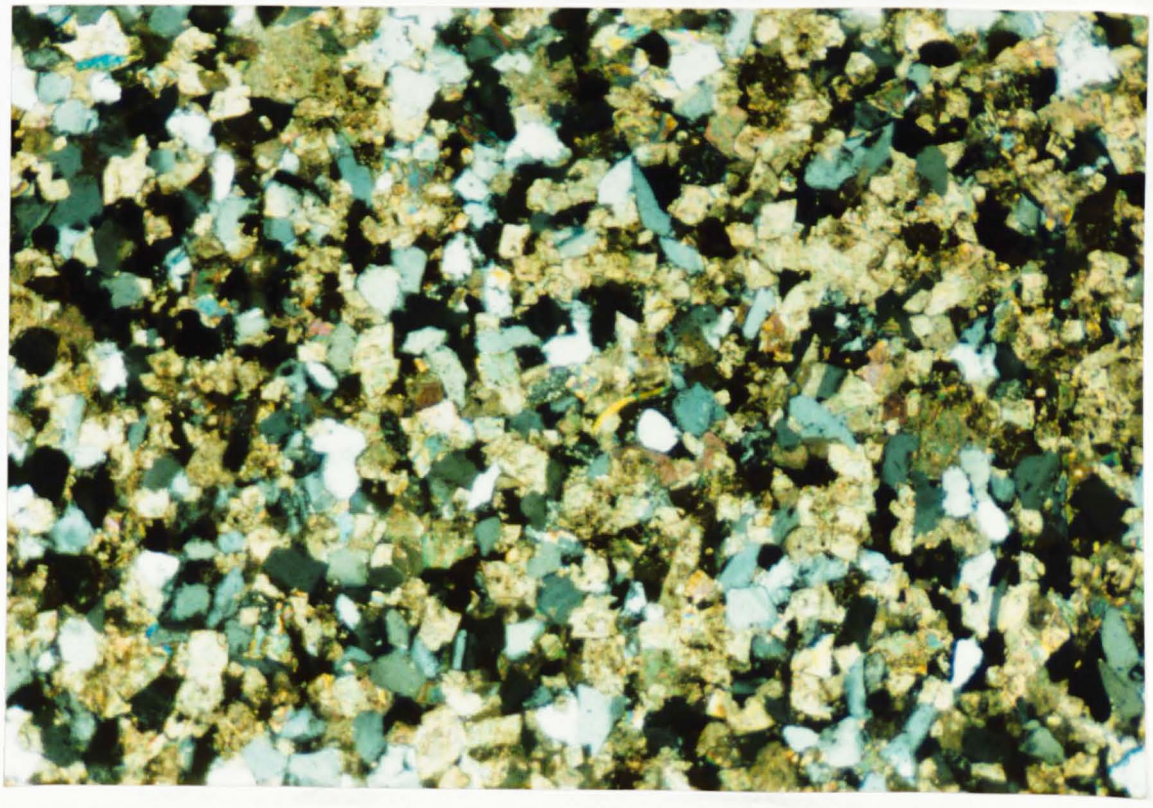
Plate 3.6 Transmitted light photograph (x-polars) illustrating the main 5 Lens dolomite. Note the patch of coarser dolomite in the centre with an absence of detrital quartz.



0.5mm

Plate 3.7 Photograph from an underground heading illustrating the Lower Dark Marker overlying pale calcarenites.

Plate 3.8 Transmitted light photograph (x-polars) of the Lower Sandstone Marker.



0.5mm

Plate 3.9a Photograph of drillcore illustrating thick microconglomerates from the 3 Lens interval in the western mine area. Way-up is to the left.

Plate 3.9b Photograph of drillcore illustrating a sharp contact at the base of a microconglomerate horizon from the 3 Lens interval in the western mine area. Way-up is to the left.

Plate 3.10 Photograph of drillcore illustrating the Nodular Marker in the western mine area. Way-up is to the left.

Plate 3.11 Photograph of drillcore illustrating vuggy, pitted dolomitization in the 1 Lens interval in the western mine area with honeyblende sphalerite crystals in the larger vugs. Way-up is to the left.

Plate 3.12 Photograph of drillcore illustrating the Upper Sandstone Marker in the western mine area. Way-up is to the left.

Plate 3.13 Photograph of drillcore illustrating typical Upper Dark Limestones. Way-up is to the right.

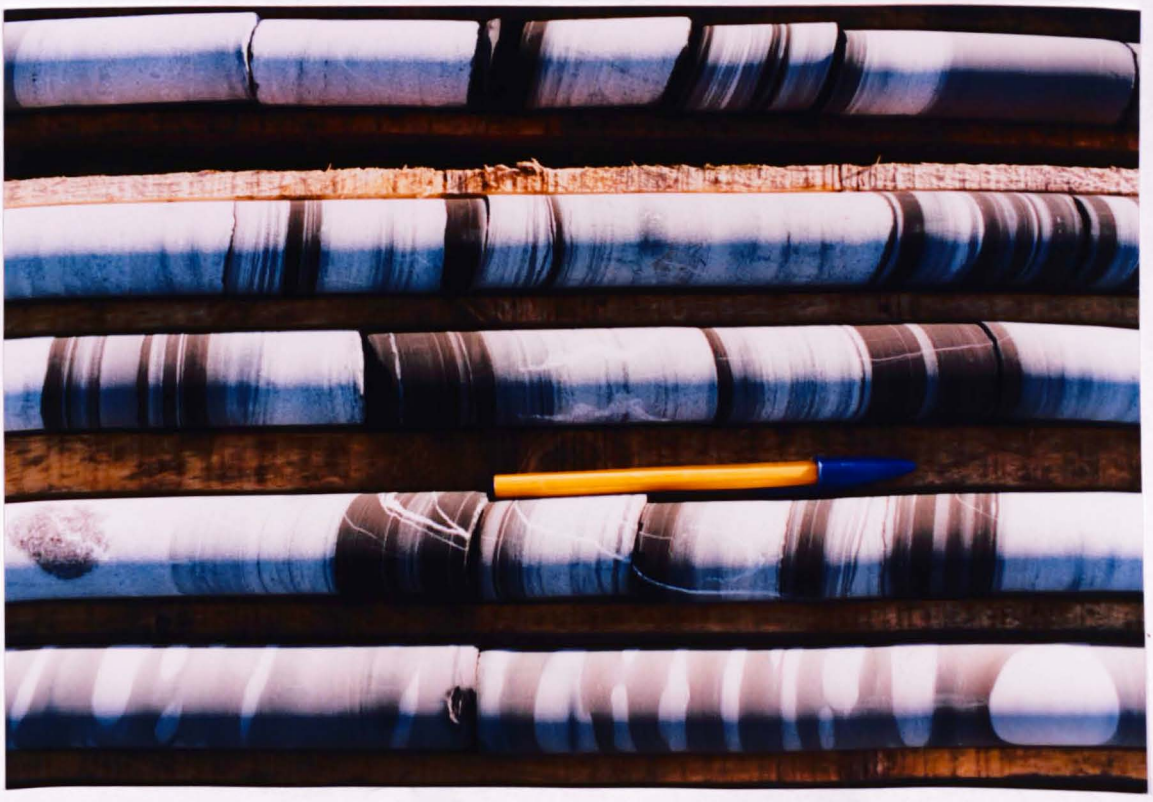
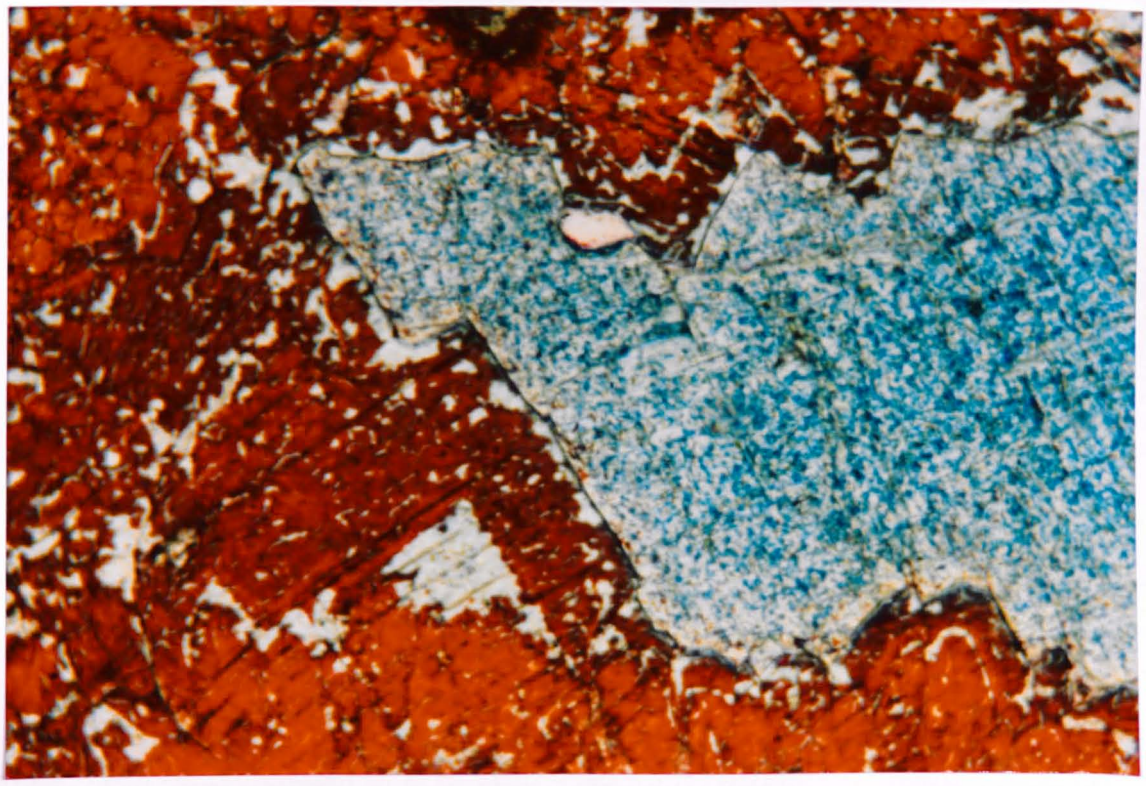
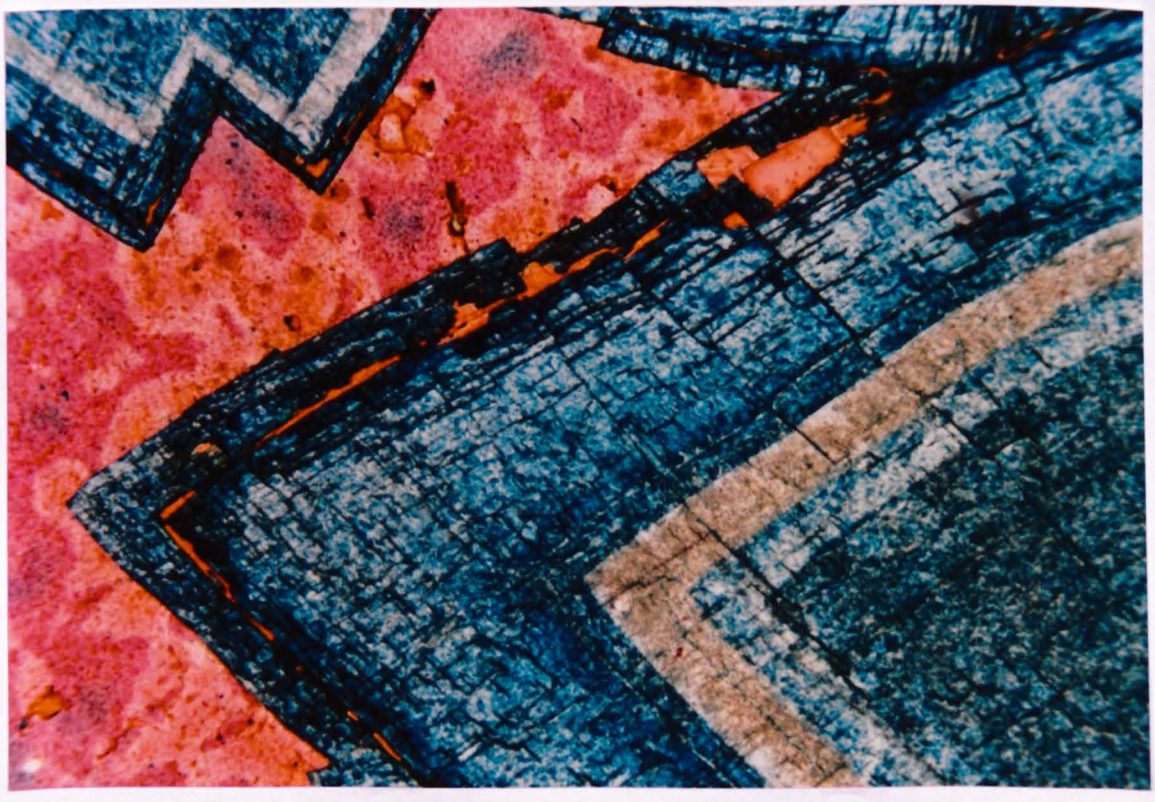


Plate 4.1a Transmitted light photograph of a stained thin section illustrating the calcite and dolomite cement sequence. Note the darker red staining in the calcite (increasing Fe) towards the ferroan dolomite (blue).

Plate 4.1b Transmitted light photograph of a stained thin section illustrating zoning within late-stage, ferroan dolomite cement.



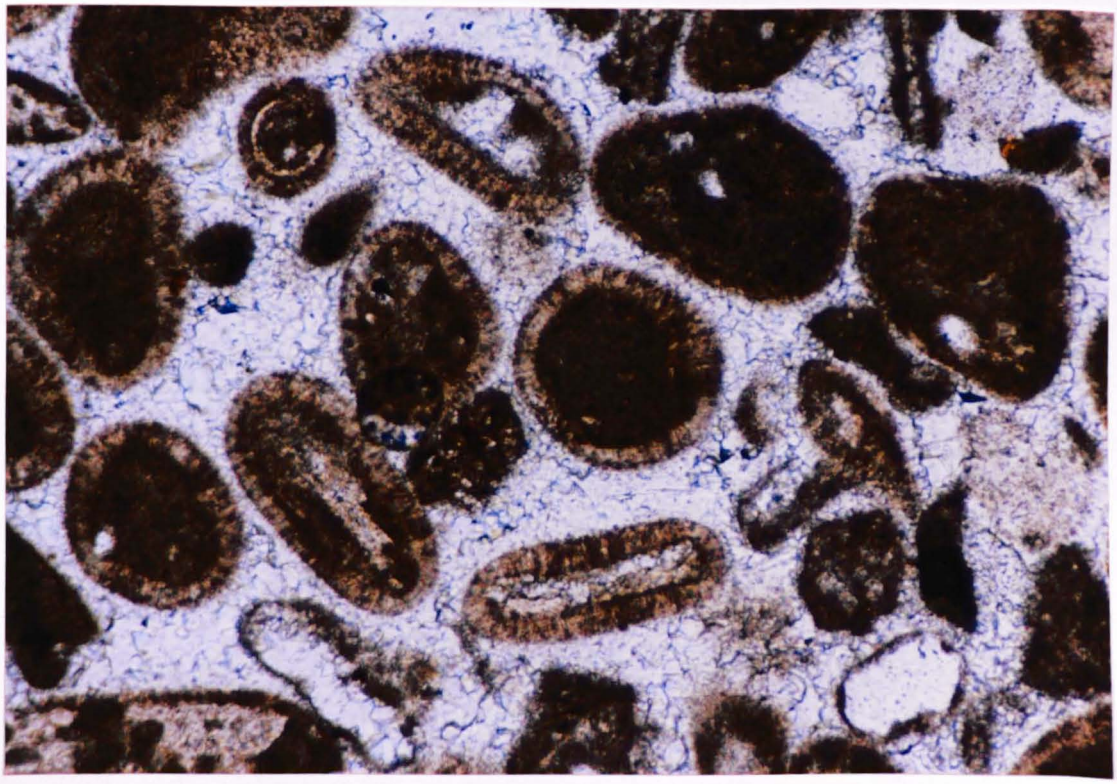
0.2mm



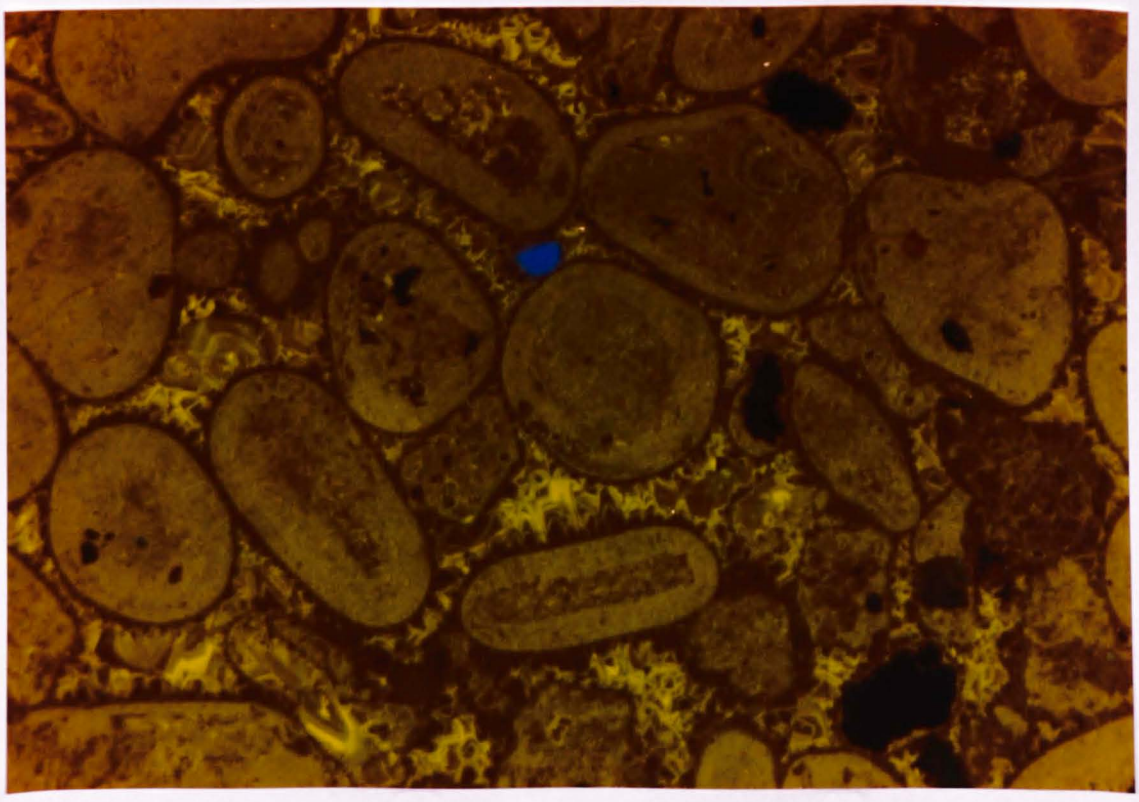
0.2mm

Plate 4.2a Transmitted light photograph illustrating calcite cements in a typical oolitic calcarenite.

Plate 4.2b Cathodoluminescent light photograph of the same field of view as Plate 4.2a, illustrating dark-non luminescent Stage a) fringing cement and later, brighter luminescent Stage b) zoned cement.



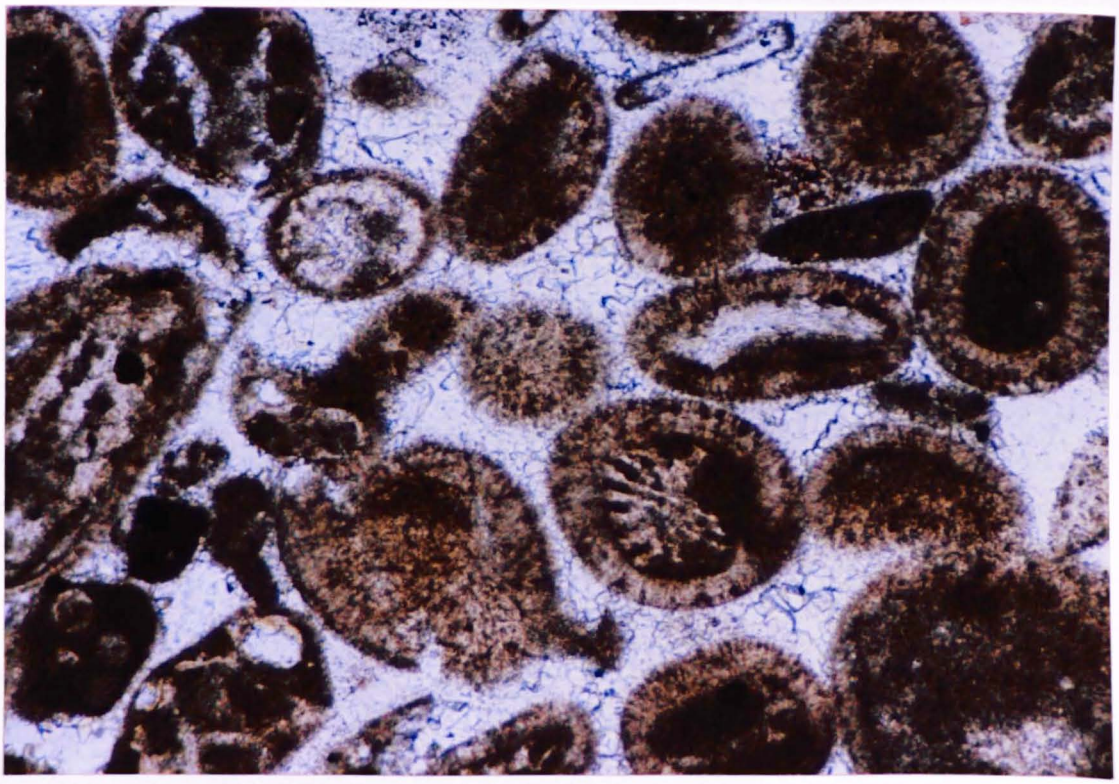
0.2mm



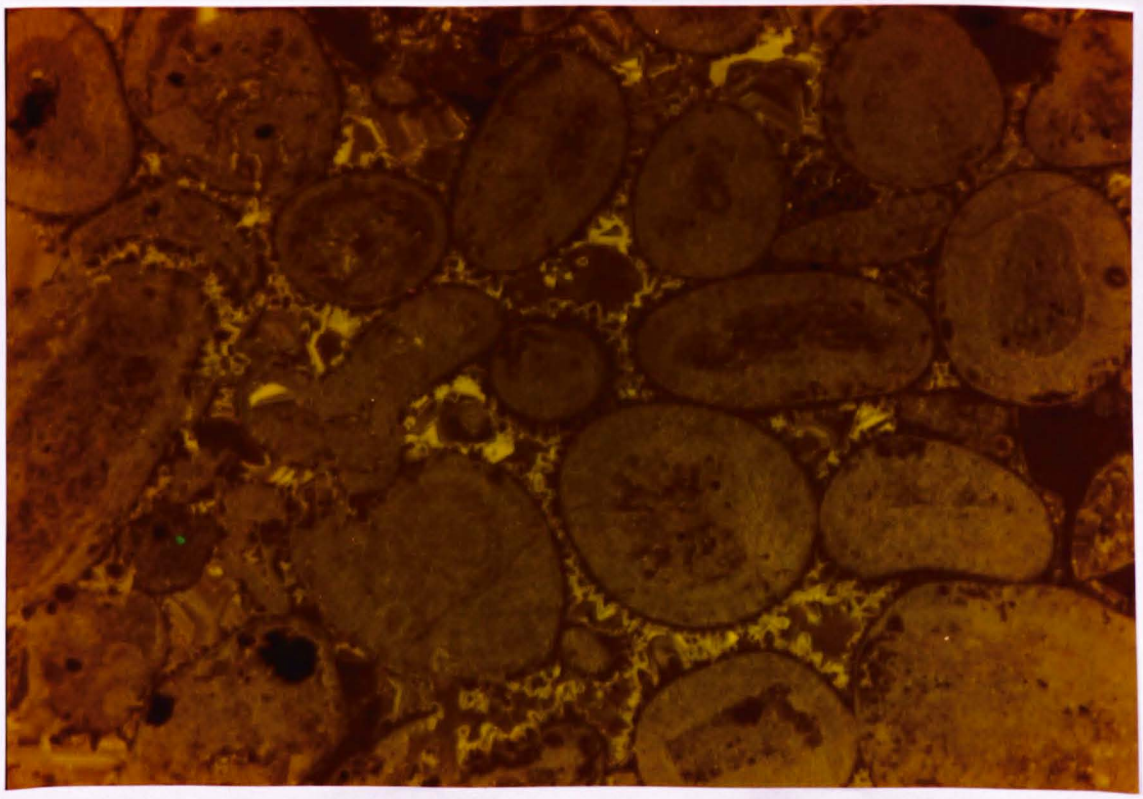
0.2mm

Plate 4.3a Transmitted light photograph illustrating calcite cements in a typical oolitic calcarenite.

Plate 4.3b Cathodoluminescent light photograph of the same field of view as Plate 4.3a, illustrating dark-non luminescent Stage a) fringing cement and later, brighter luminescent Stage b) zoned cement.



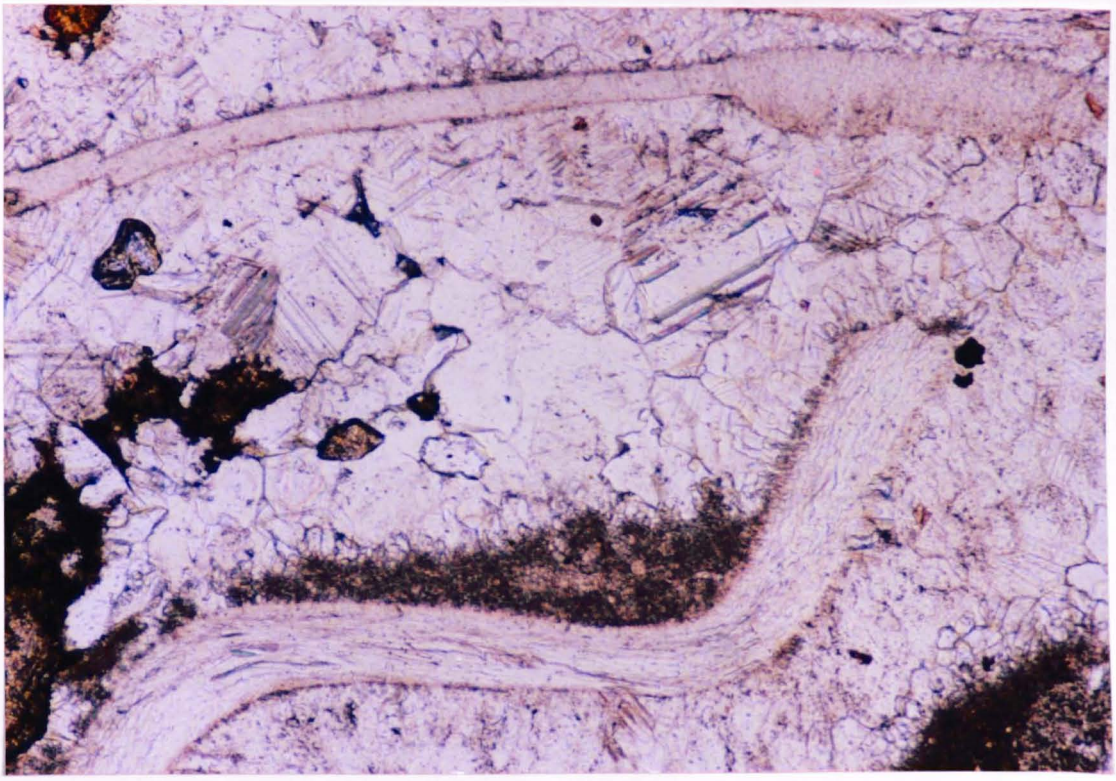
0.2mm



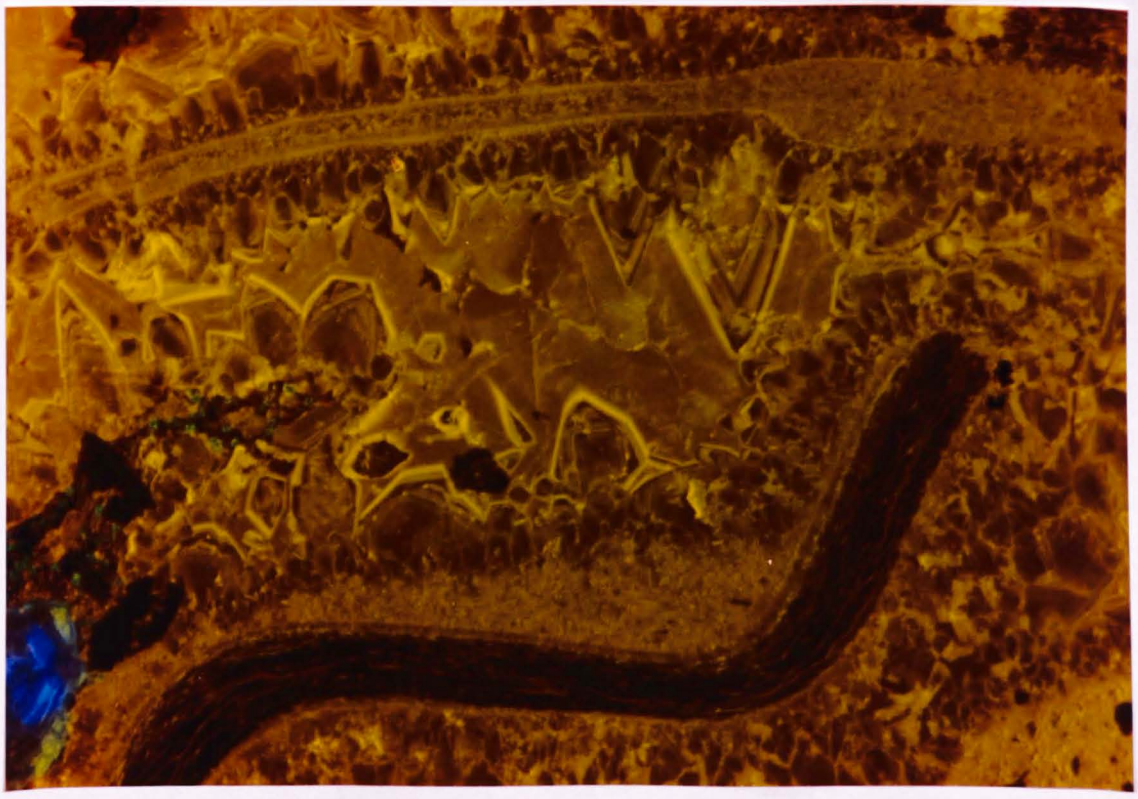
0.2mm

Plate 4.4a Transmitted light photograph illustrating calcite cements in a coarsely bioclastic calcarenite.

Plate 4.4b Cathodoluminescent light photograph of the same field of view as Plate 4.4a, illustrating dark-non luminescent Stage a) bladed cement, medium-bright luminescent Stage b) well-zoned cement, and medium luminescent Stage c) blocky infill.



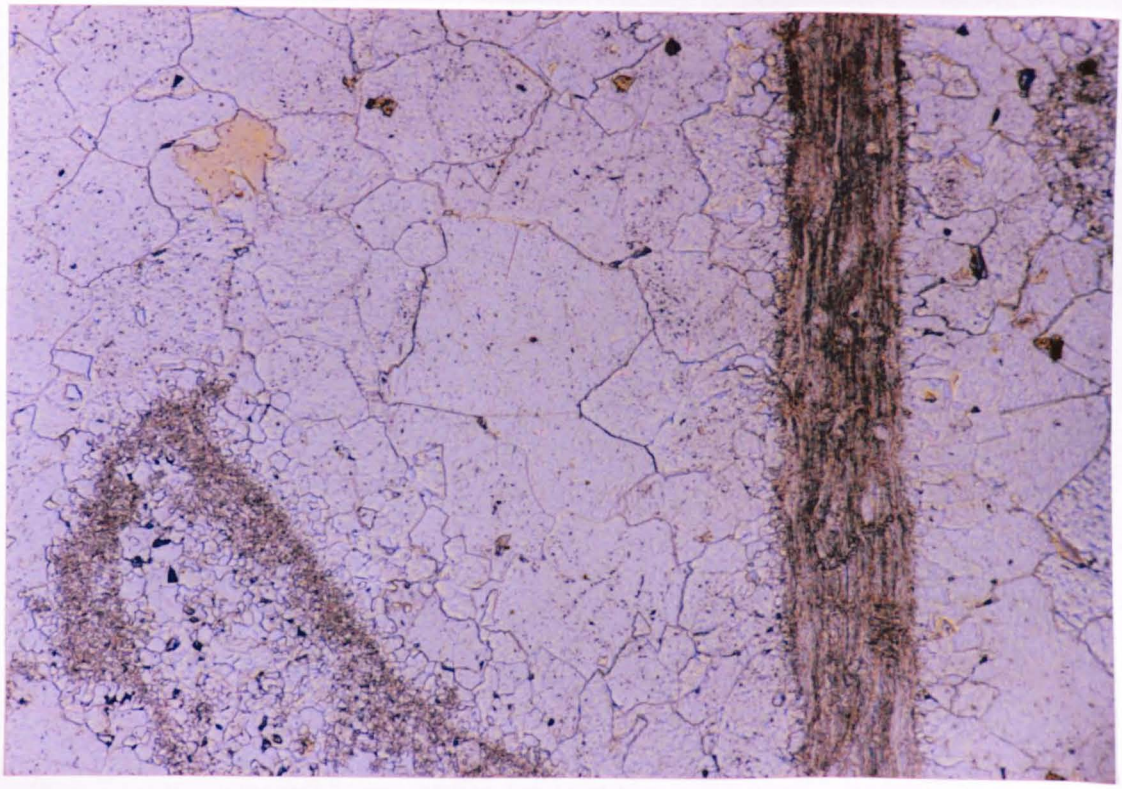
0.2mm



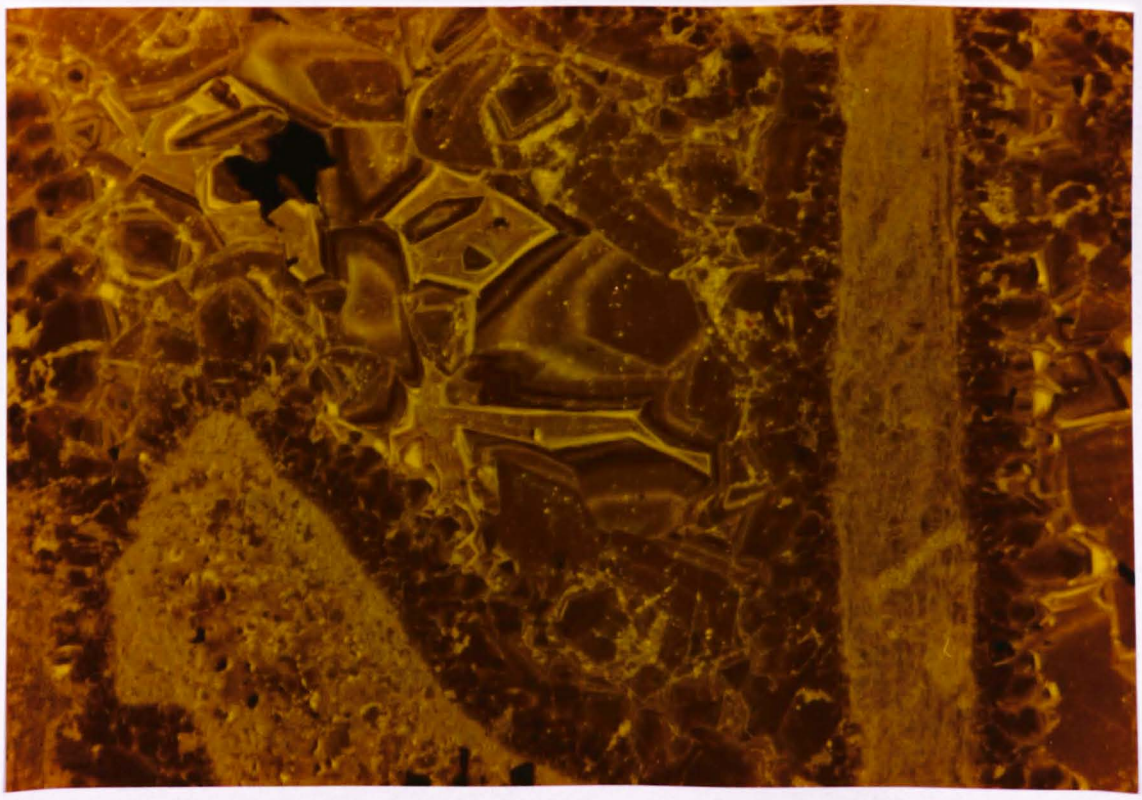
0.2mm

Plate 4.5a Transmitted light photograph illustrating calcite cements in a coarse bioclastic calcarenite.

Plate 4.5b Cathodoluminescent light photograph of the same field of view as Plate 4.5a, illustrating dark-non luminescent Stage a) bladed cement, medium-bright luminescent Stage b) well-zoned cement, and medium luminescent Stage c) blocky infill.



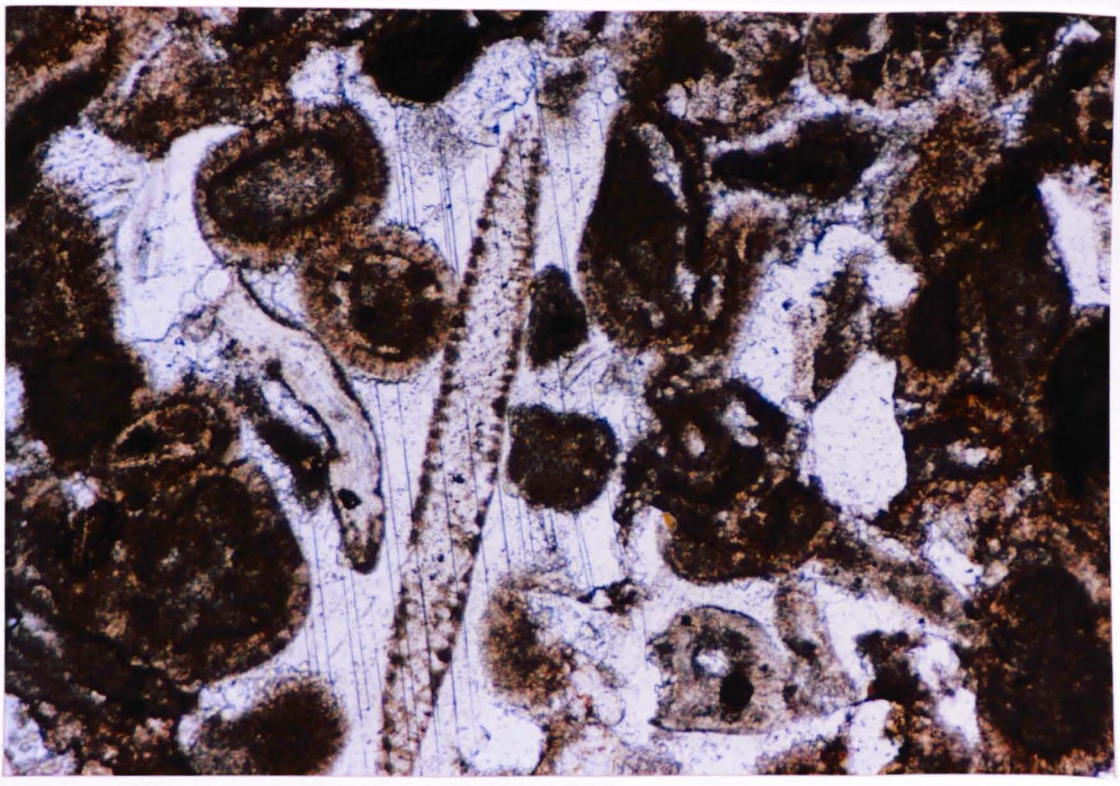
0.2mm



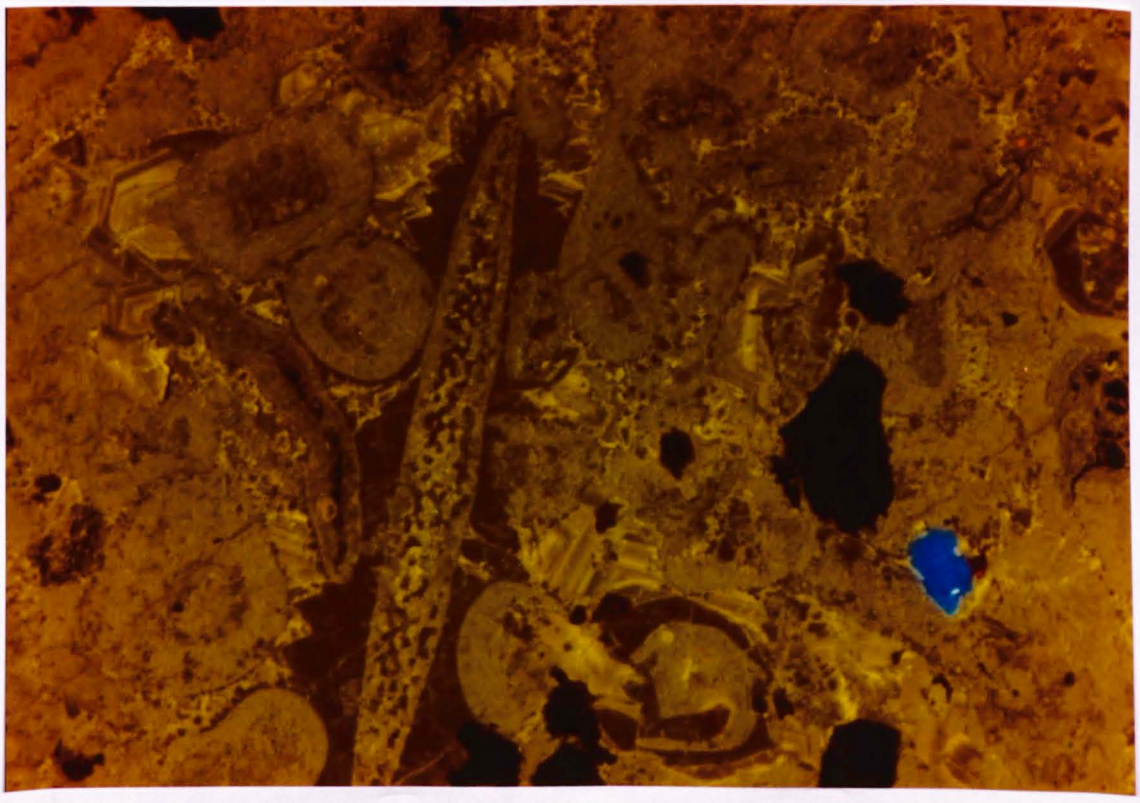
0.2mm

Plate 4.6a Transmitted light photograph illustrating calcite cement overgrowths on echinoderm fragments.

Plate 4.6b Cathodoluminescent light photograph of the same field of view as Plate 4.6a, illustrating calcite cements (Stages a and b) as contouring overgrowths on echinoderm fragments. Note the preferential development of Stage a) around the echinoid fragments.



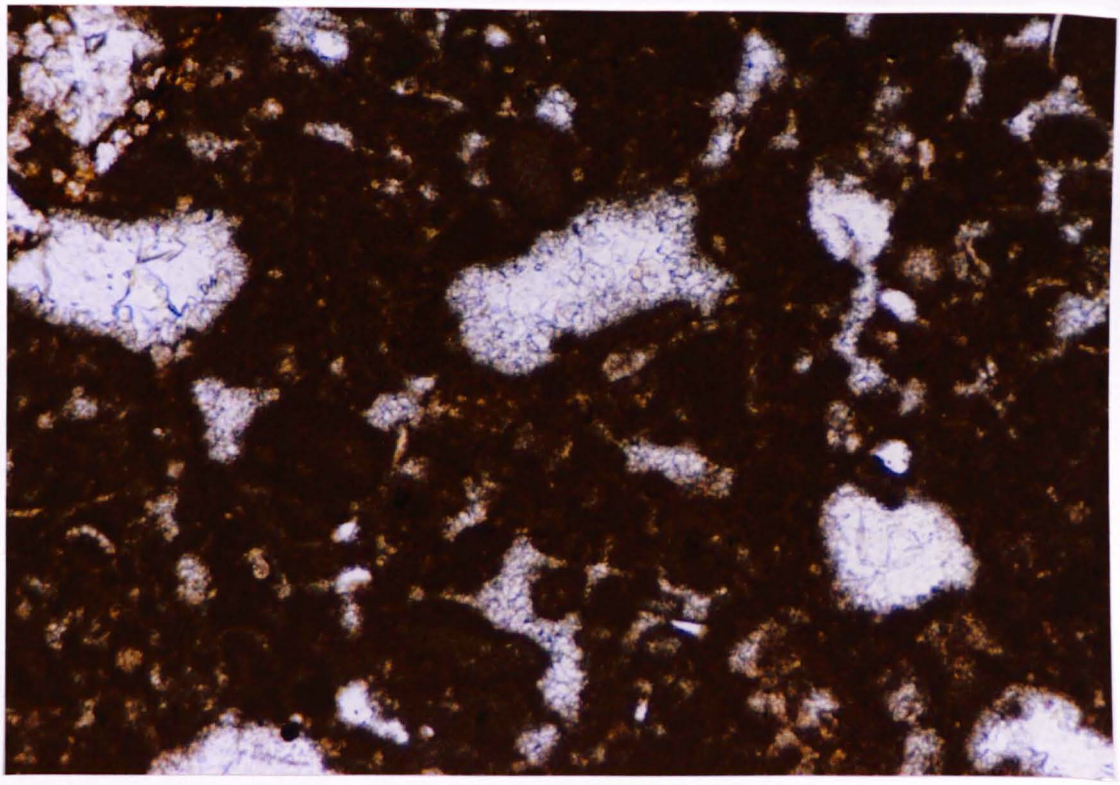
0.2mm



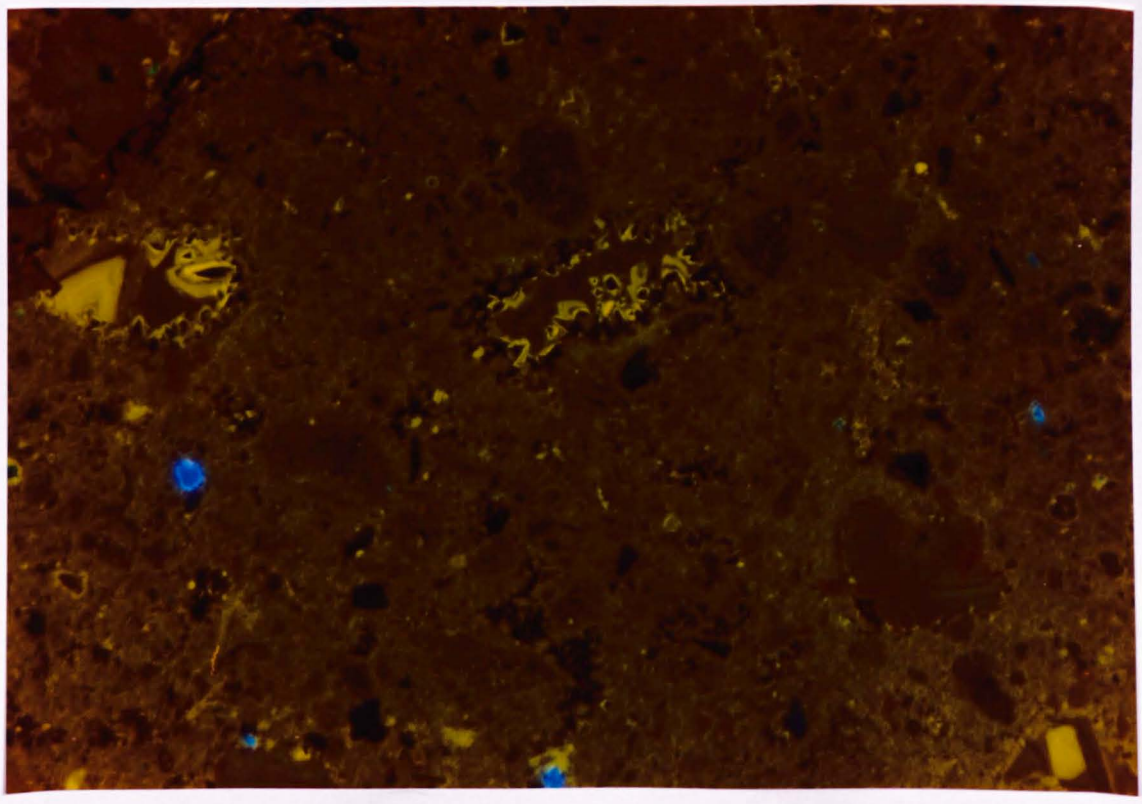
0.2mm

Plate 4.7a Transmitted light photograph illustrating birdseyes in micrites from the 5 Lens interval.

Plate 4.7b Cathodoluminescent light photograph of the same field of view as Plate 4.7a, illustrating calcite cements (Stages a,b and c) within birdseyes in micrites.



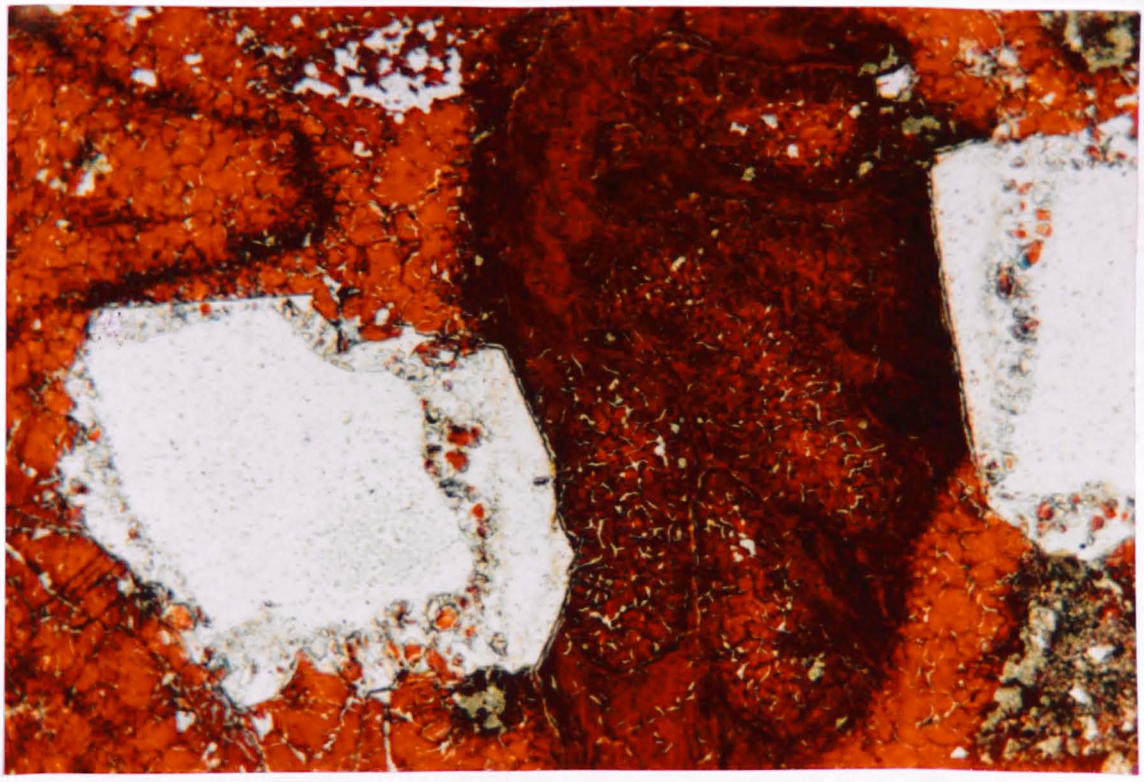
0.2mm



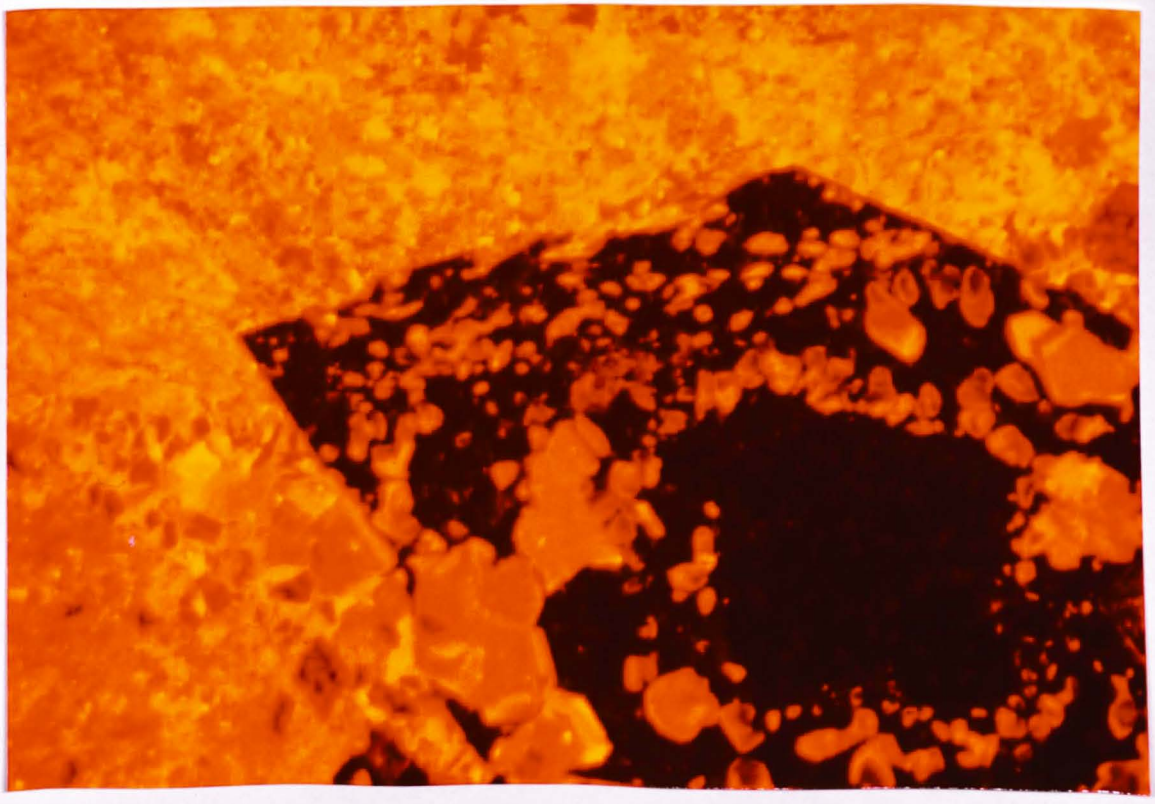
0.2mm

Plate 4.8a Transmitted light photograph of a stained thin section prepared from a bioclastic calcarenite, illustrating calcite inclusions within authigenic quartz overgrowths developed on original detrital quartz grains.

Plate 4.8b Cathodoluminescent light photograph of a bioclastic calcarenite illustrating calcite inclusion trails within authigenic quartz overgrowths developed on an original detrital quartz grain.



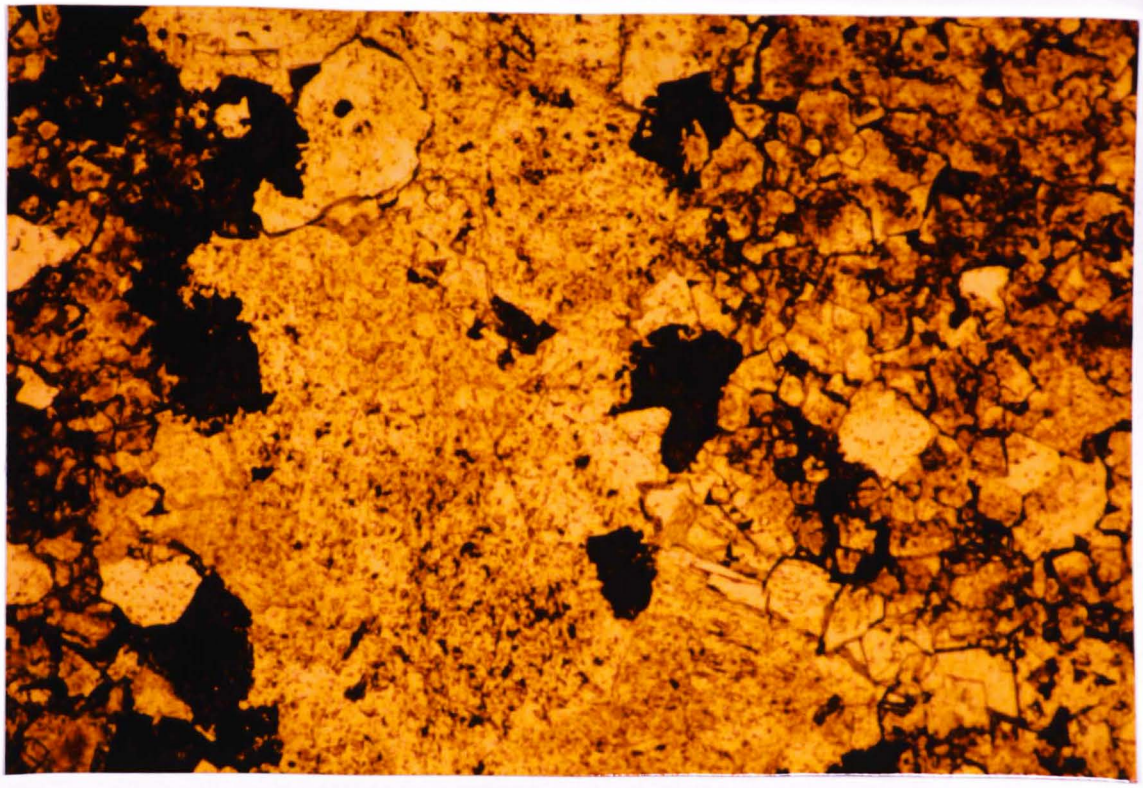
0.2mm



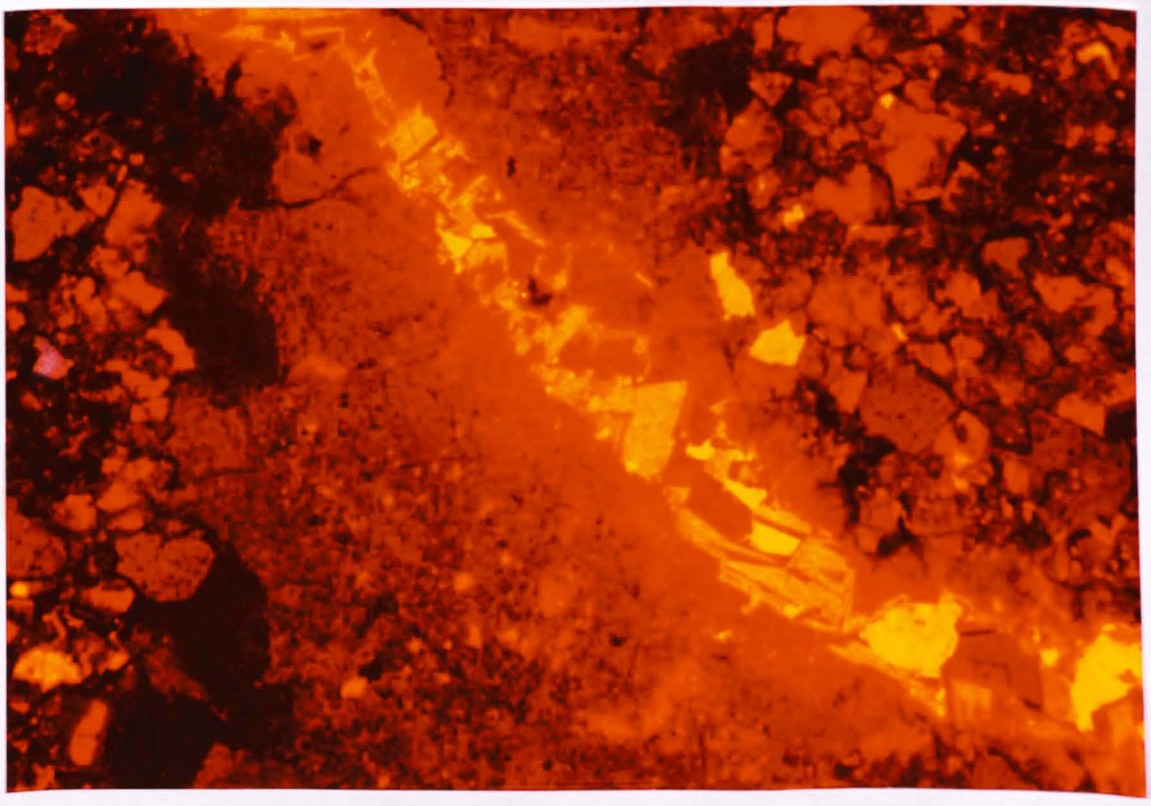
0.1mm

Plate 4.9a Transmitted light photograph of a detrital silt-rich dolomite illustrating a cross-cutting, coarse dolomite vein containing dark sphalerite on the edges of the vein.

Plate 4.9b Cathodoluminescent light photograph of the same field of view as Plate 4.9a. Due to the overall darkness of the field of view under CL, the picture is over-exposed. CL reveals that dark-non luminescent dolomite (Stage 2) in the sphalerite-bearing vein is cross-cut by a later vein filled with bright red/dark-non luminescent dolomite (Stage 3) and later bright yellow luminescent calcite (Stage 4). Due to the over-exposure it is difficult to distinguish between Stages 3 and 4.



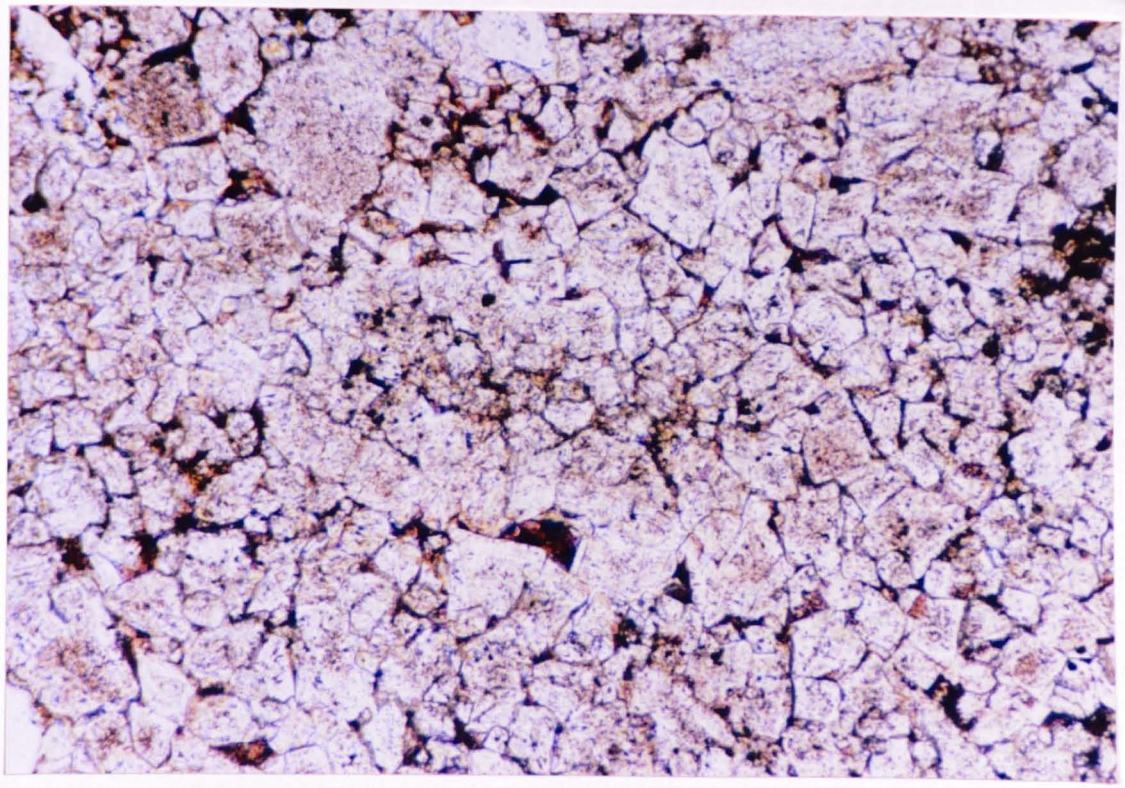
0.2mm



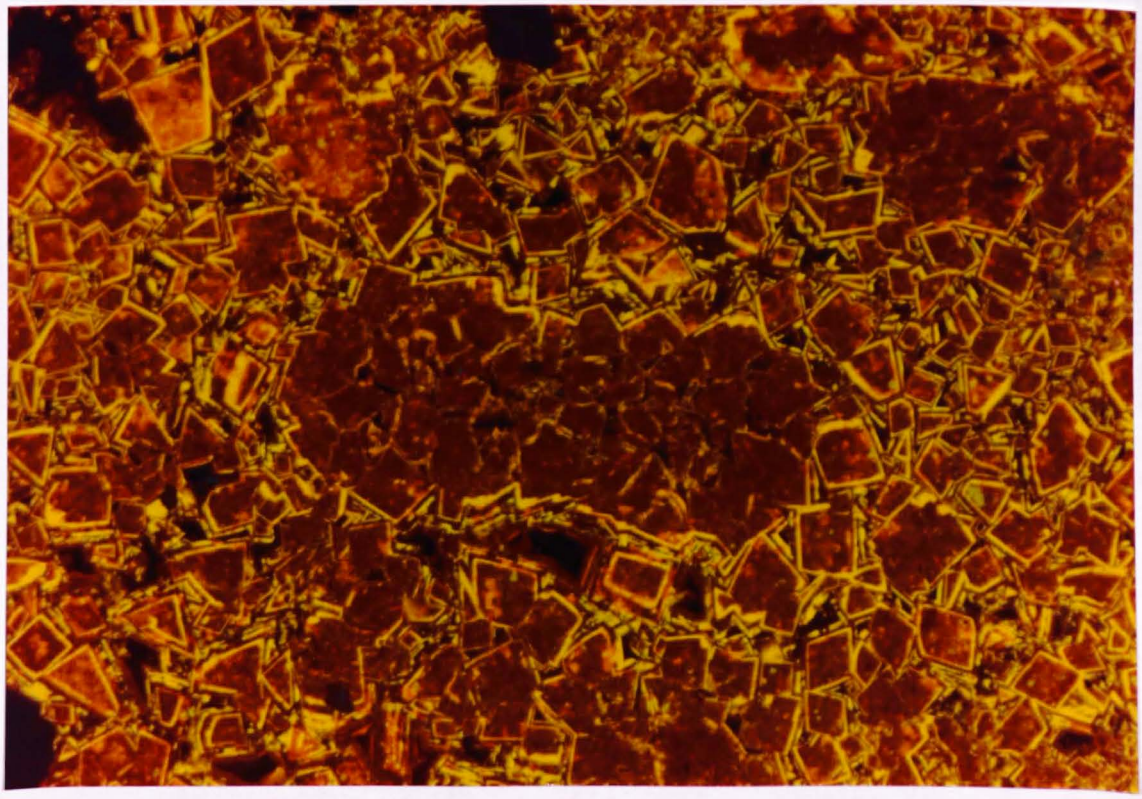
0.2mm

Plate 4.10a Transmitted light photograph illustrating a pervasive, pitted dolomite from the western mine area.

Plate 4.10b Cathodoluminescent light photograph of the same field of view as Plate 4.10a, illustrating dolomitization of an original pellet/intraclast and surrounding cement by dolomite Stages A (dull brown luminescence) and B (bright, zoned luminescence). Note the different styles of dolomite replacement between original carbonate allochems and cement.



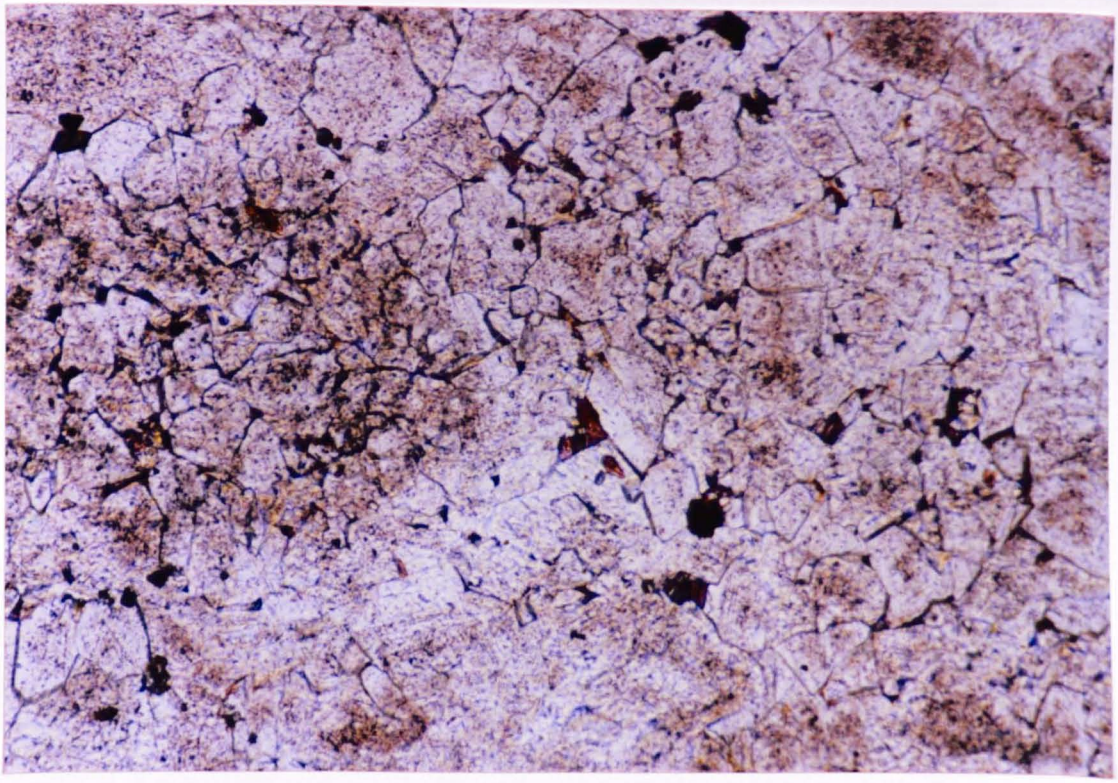
0.2mm



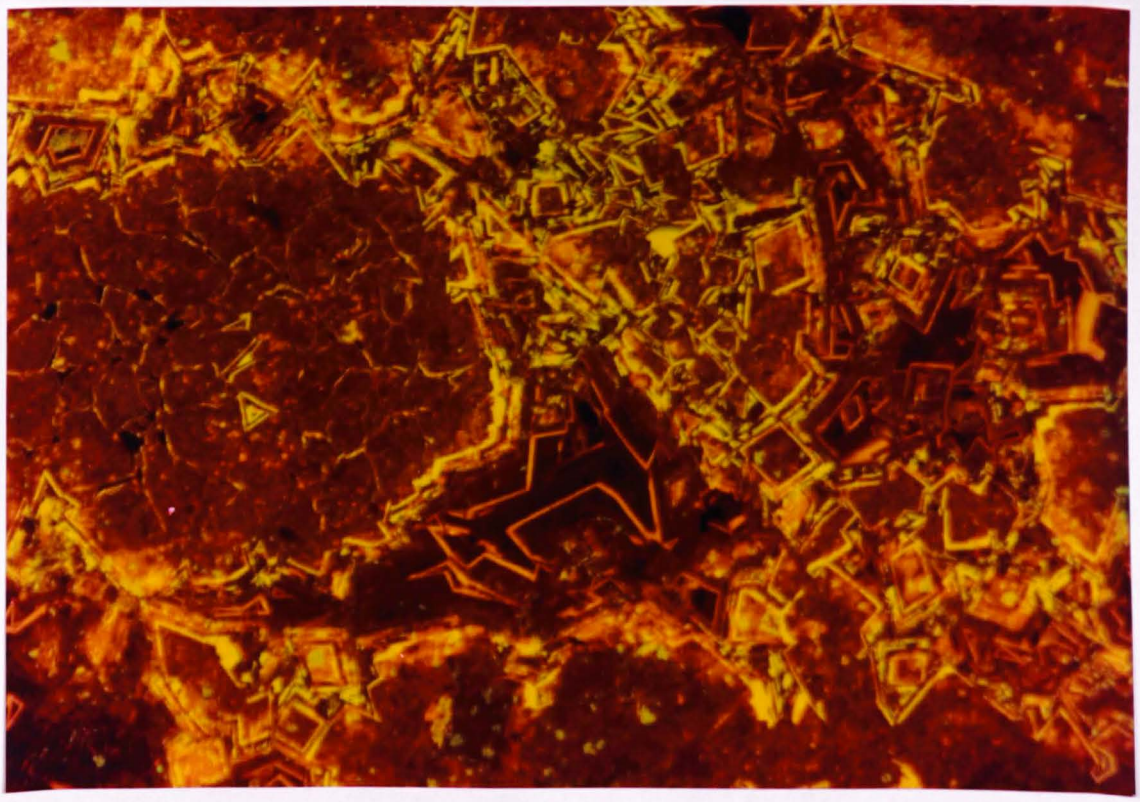
0.2mm

Plate 4.11a Transmitted light photograph illustrating pervasive, pitted dolomitization from the western mine area.

Plate 4.11b Cathodoluminescent light photograph of the same field of view as Plate 4.11a, illustrating dolomite Stages A-C, with Stage C (dark luminescence with a bright red zone) deposited as a cement infilling the remaining porosity after Stages A and B.



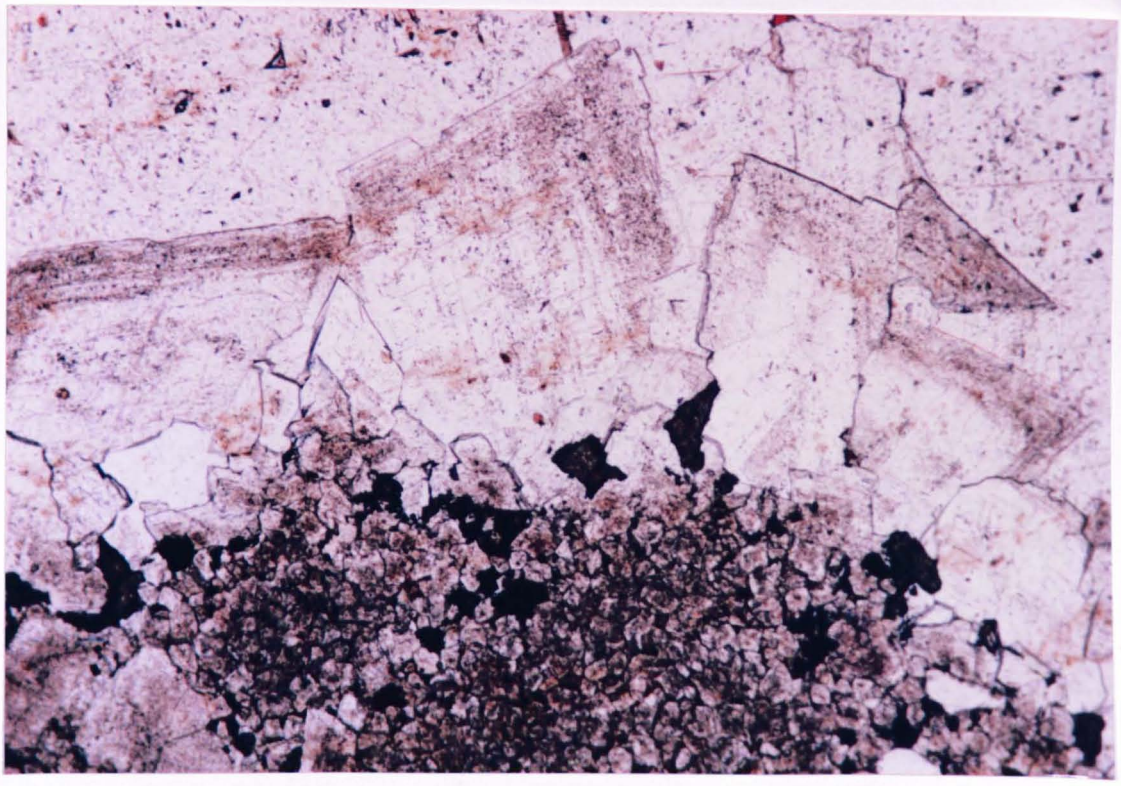
0.2mm



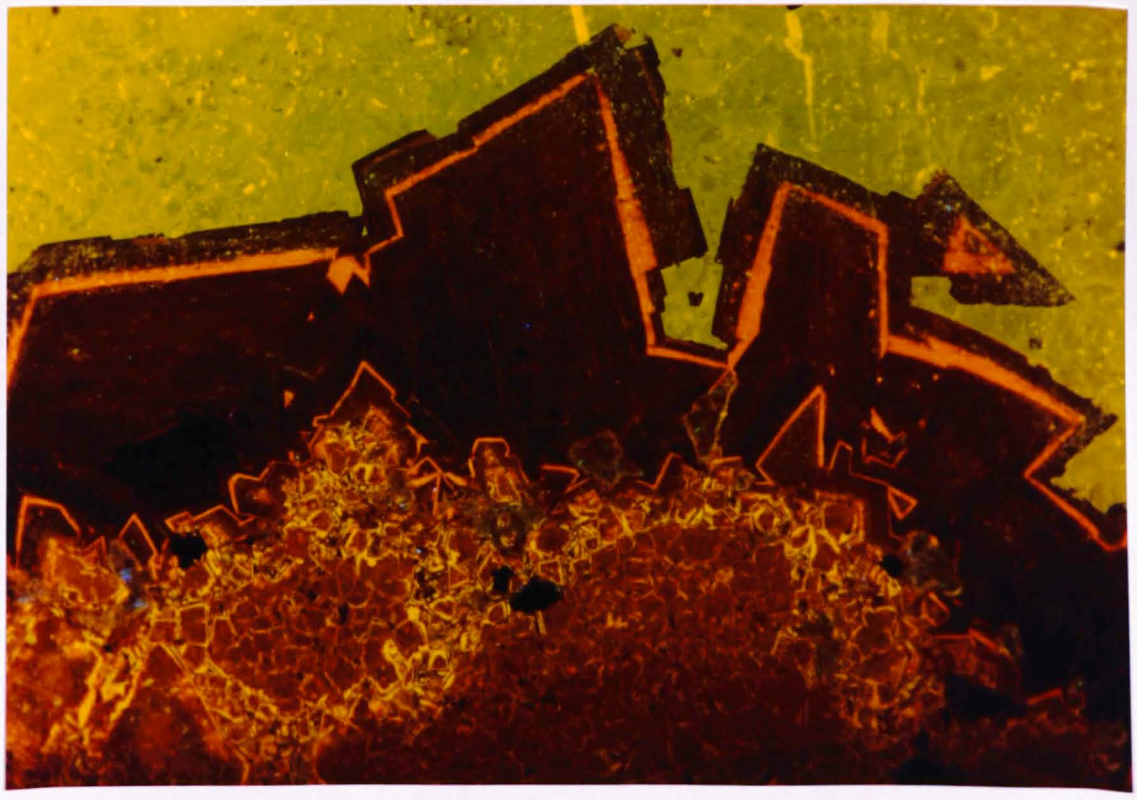
0.2mm

Plate 4.12a Transmitted light photograph of the vuggy dolomitization from the western mine area illustrating coarse dolomite crystals precipitated on the edges of the vug.

Plate 4.12b Cathodoluminescent light photograph of the same field of view as Plate 4.12a, illustrating dark luminescent dolomite (Stage C) and late-stage, medium-bright yellow luminescent calcite (Stage D).



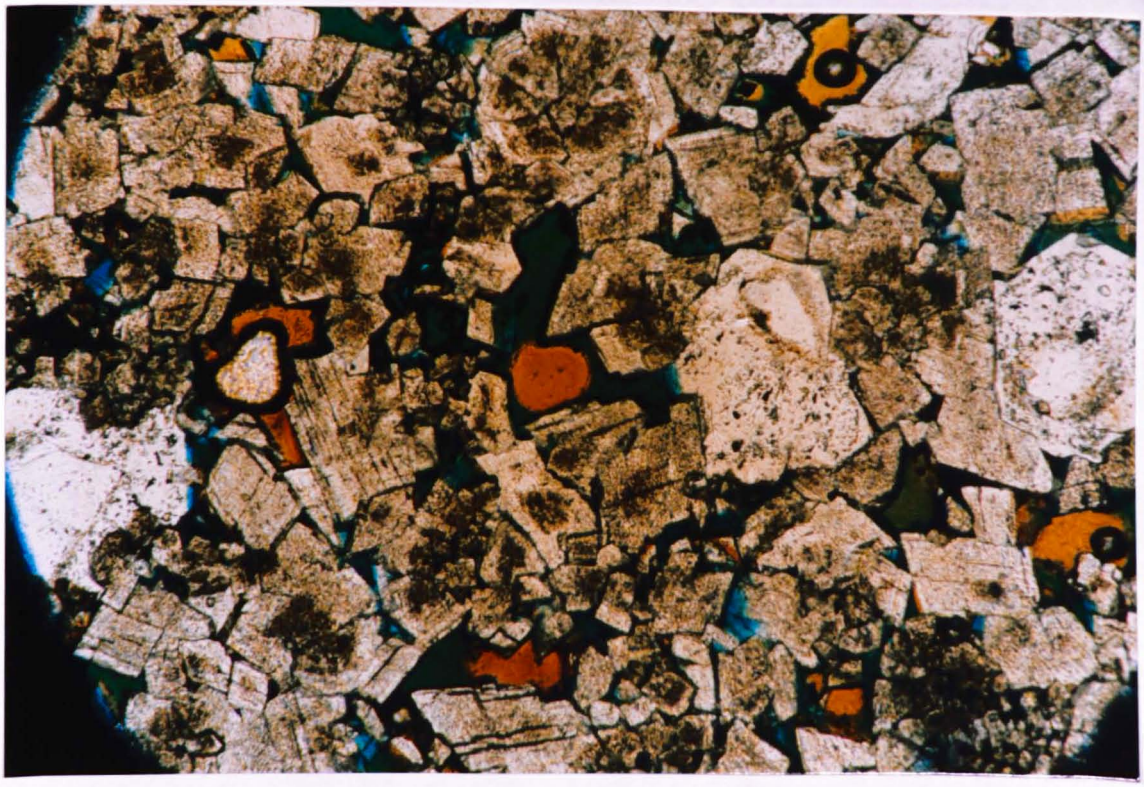
0.5mm



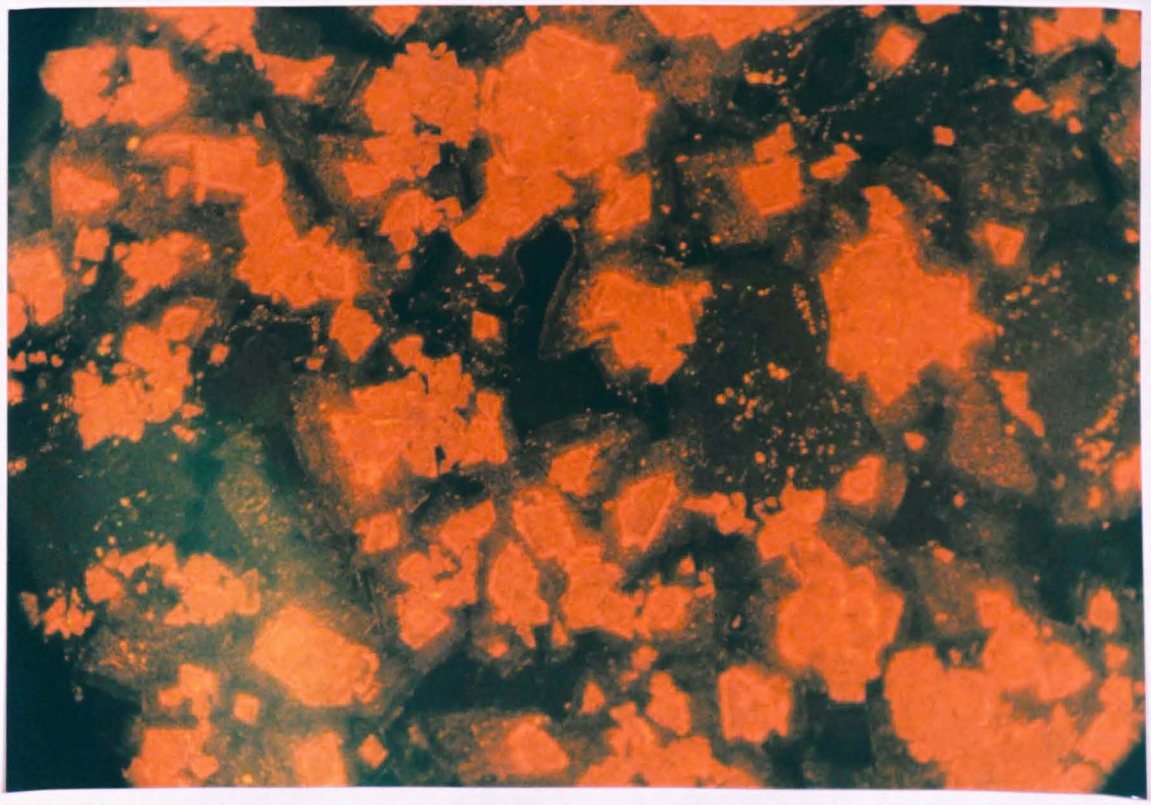
0.5mm

Plate 4.13a Transmitted light photograph of a pitted dolomite from the western mine area illustrating cloudy dolomite cores with clearer rims.

Plate 4.13b Cathodoluminescent light photograph of the same field of view as Plate 4.13a, illustrating bright red luminescent dolomite cores corresponding with the cloudy dolomite under transmitted light, and dark luminescent rims corresponding with the clearer dolomite. Authigenic quartz overgrowths contain numerous calcite inclusions (see Plate 4.14b)

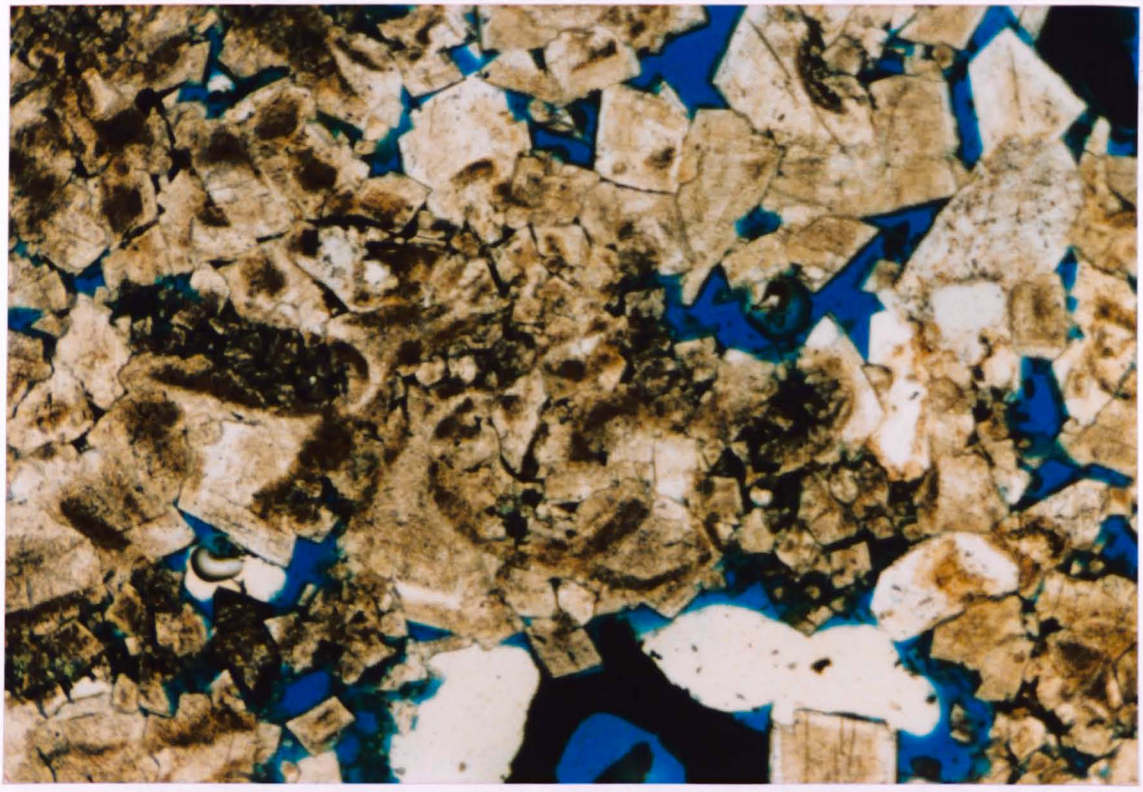


0.2mm



0.2mm

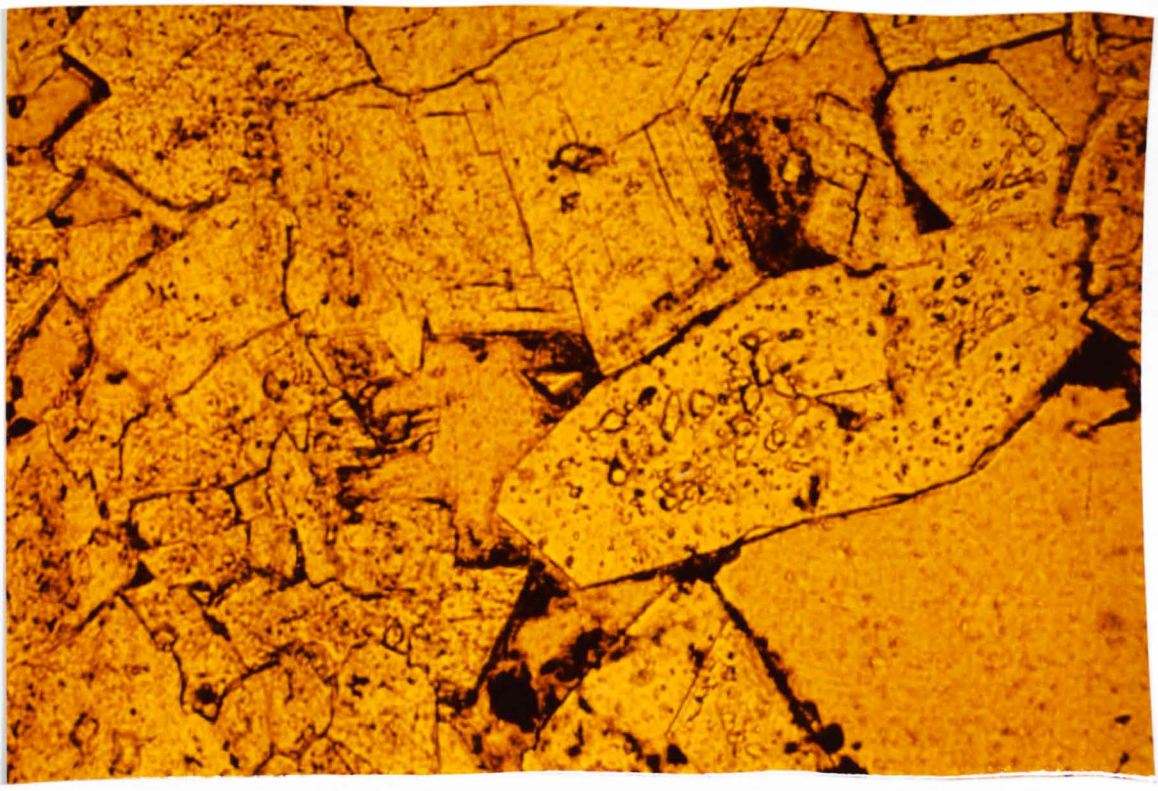
Plate 4.13c Transmitted light photograph of a resin impregnated thin section prepared from pitted dolomites from the western mine area, illustrating ghost allochems within the dolomite.



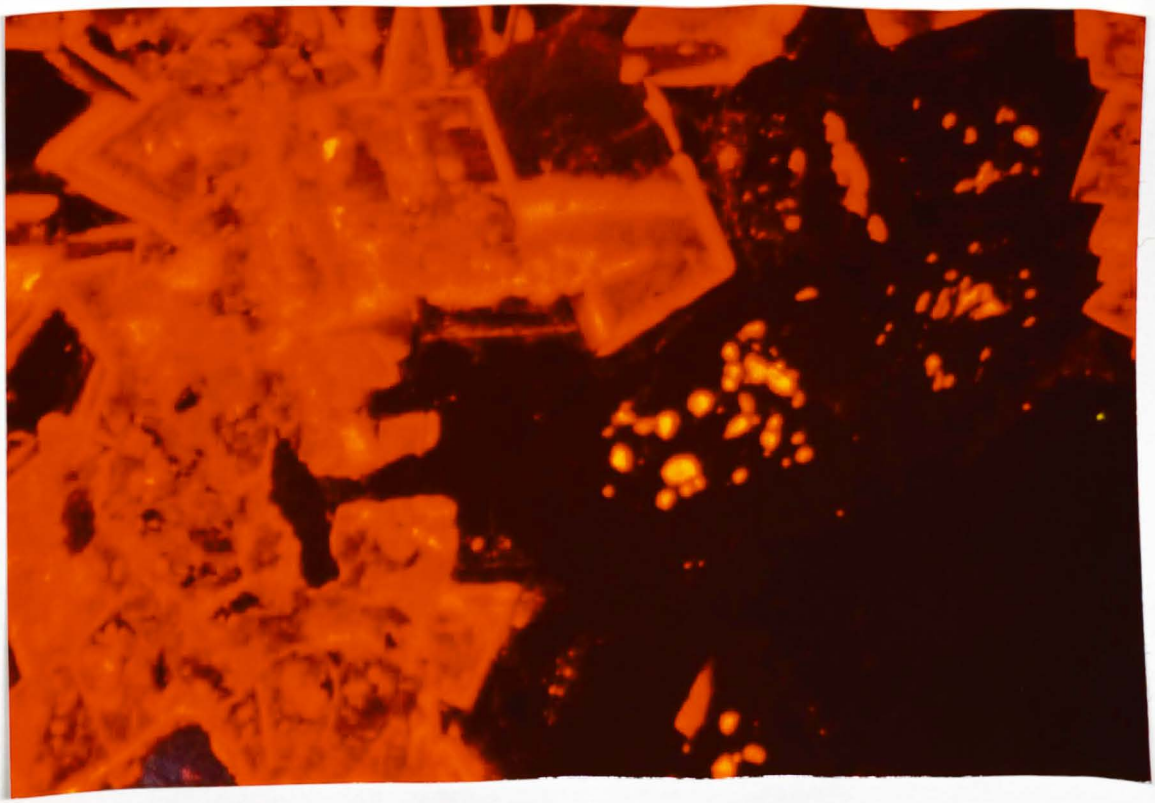
0.2mm

Plate 4.14a Transmitted light photograph of a pitted dolomite from the western mine area illustrating small inclusions within authigenic quartz overgrowths.

Plate 4.14b Cathodoluminescent light photograph of the same field of view as Plate 4.14a and illustrating yellow luminescent calcite inclusions within authigenic quartz overgrowths on detrital quartz grains. The calcite inclusions imply that the silicification pre-dated the dolomitization.



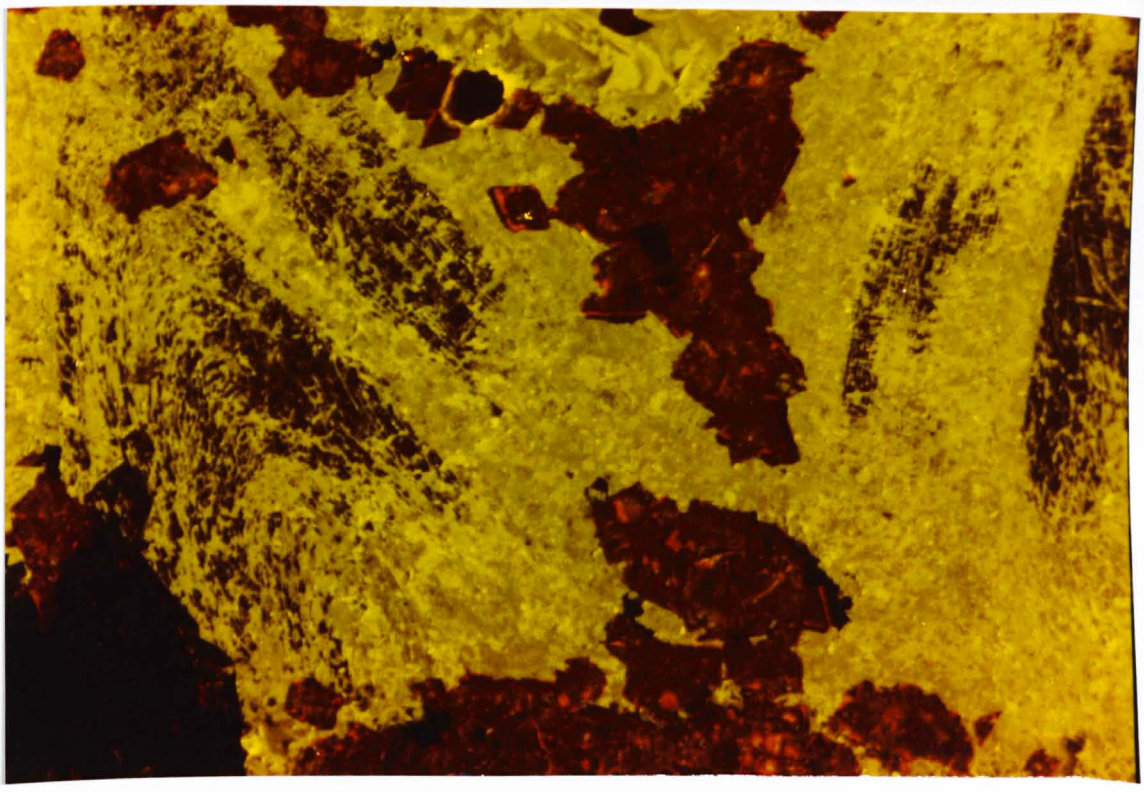
0.1mm



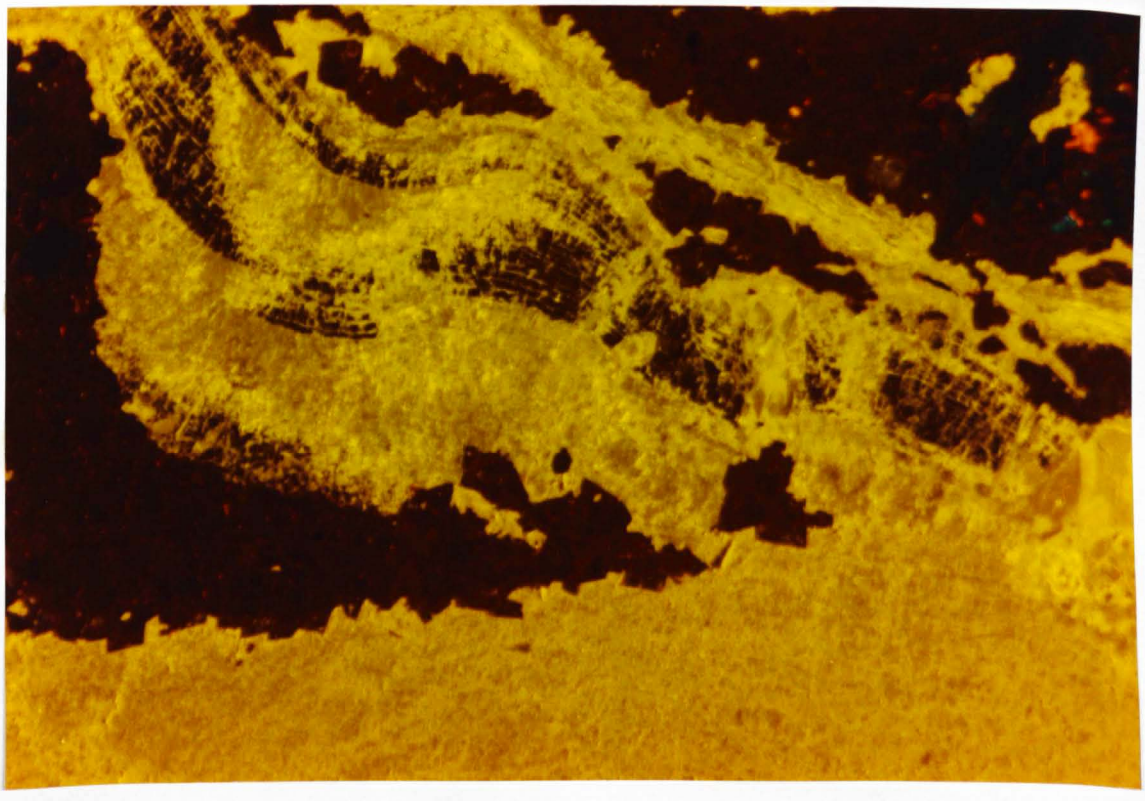
0.1mm

Plate 4.15a Cathodoluminescent light photograph illustrating neomorphism of brachiopod shell fragments by a blotchy, medium luminescent calcite. Note the corrosion of the dark dolomite rhombs by the calcite implying that the dolomitization pre-dated the neomorphism.

Plate 4.15b Cathodoluminescent light photograph illustrating neomorphism of shell fragments by a blotchy, medium luminescent calcite.



0.2mm



0.2mm

Plate 5.1 Photograph from an underground heading in 2-1 Lens (222W) illustrating bedding-parallel, sphalerite replacement of calcarenites. Hammer for scale.

Plate 5.2 Photograph from an underground heading in 2-3 Lens illustrating bedding-parallel sphalerite layers which formed by replacement of semi-lithified calcarenites and were subsequently disrupted. Hammer for scale.

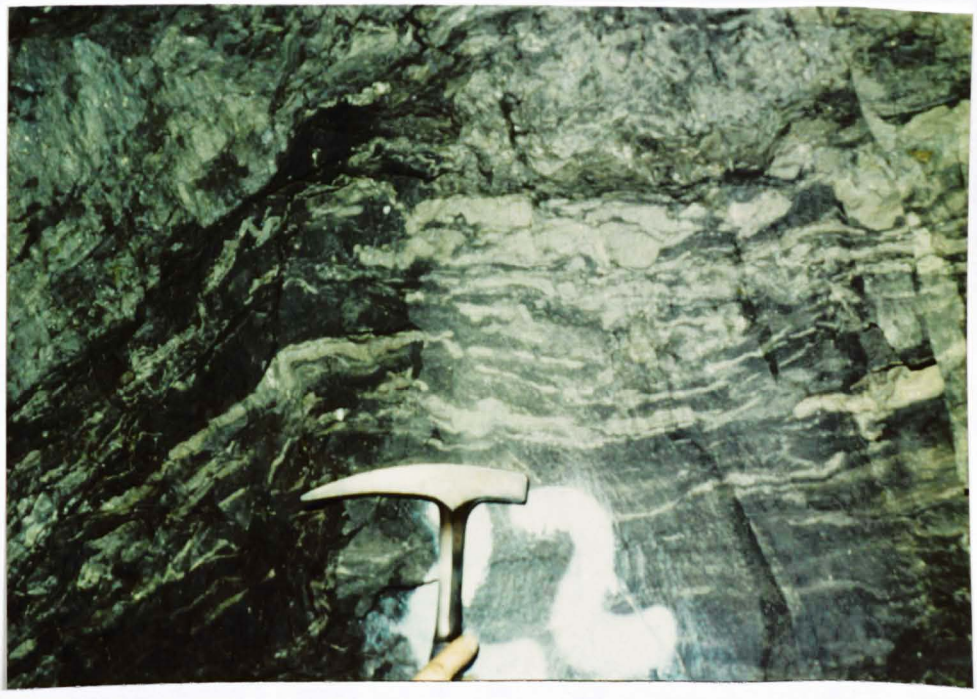
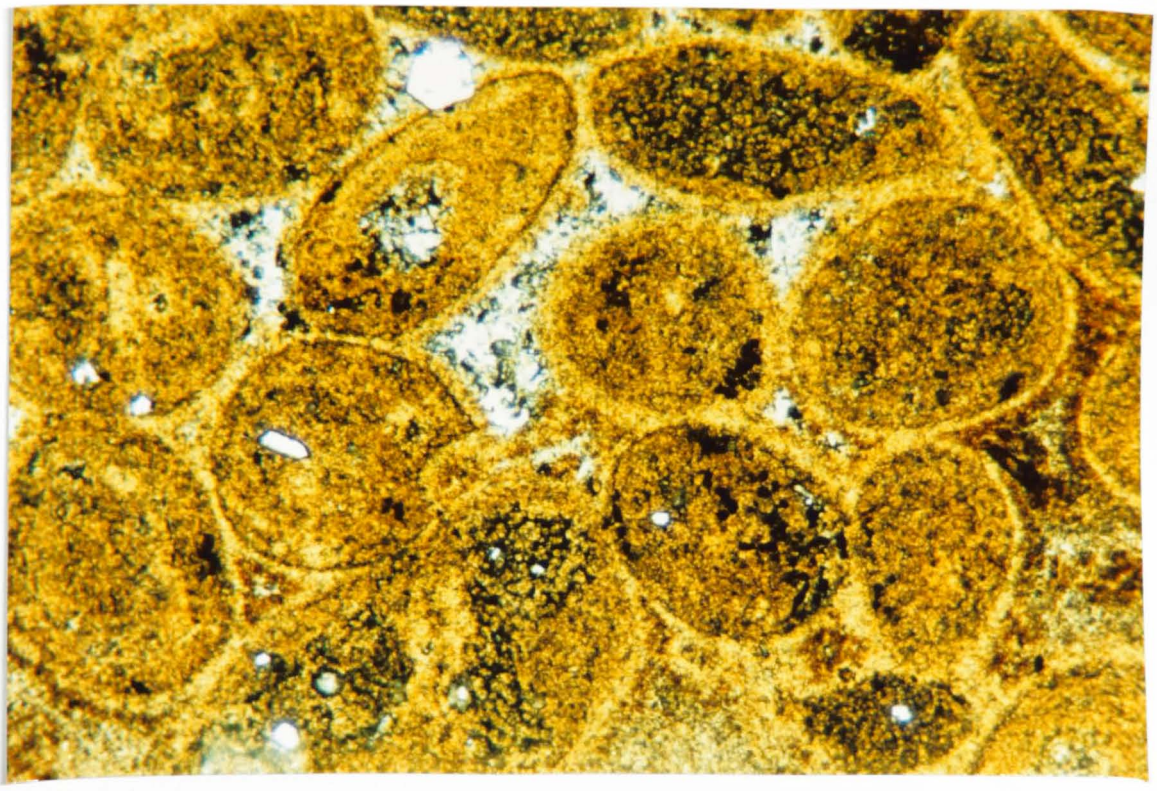


Plate 5.3 Photograph of a hand specimen from 2-1 Lens (222W) illustrating sphalerite layers formed by replacement of calcarenites. Coin for scale.

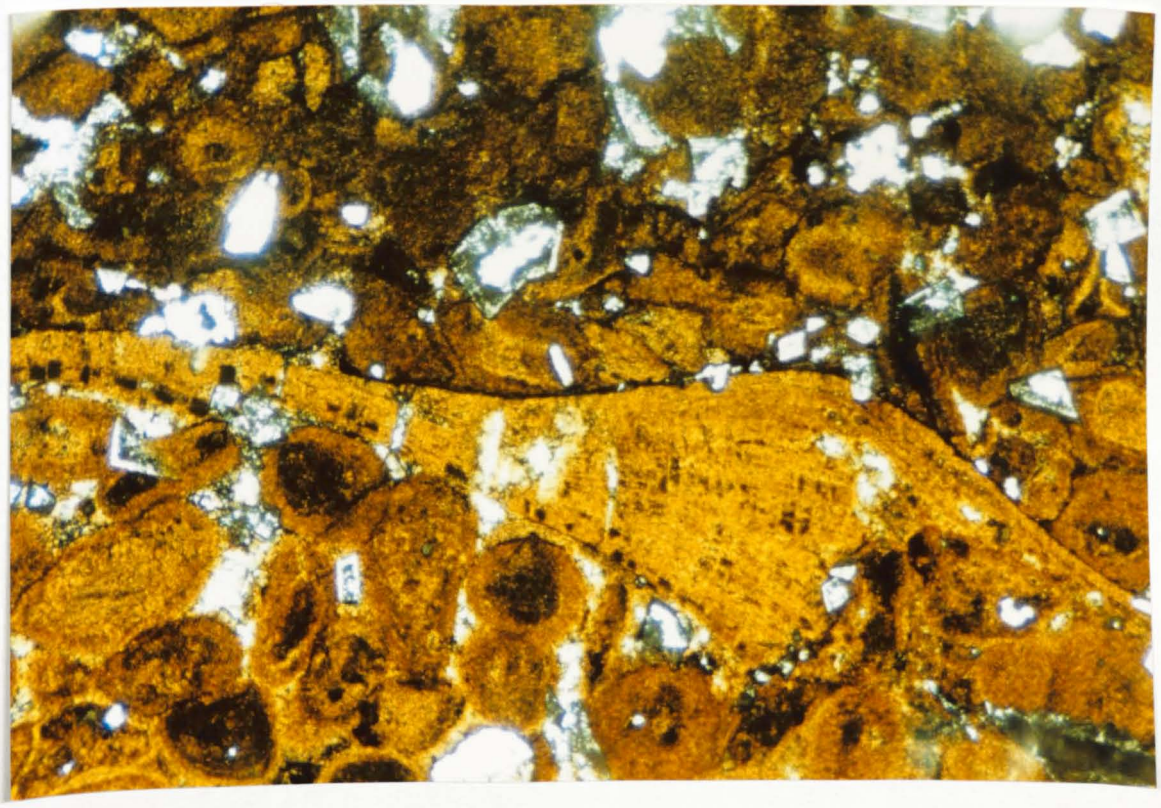
Plate 5.4 Photograph of drillcore from 2-1 Lens illustrating disrupted, buckled sphalerite layers within a calcarenite.

Plate 5.5a Transmitted light photograph illustrating oolites replaced by sphalerite (2-2 Lens, W20S). The light coloured areas between the replaced oolites consist of honeyblende sphalerite deposited as an open space infill (ie, not replacement) and implies that the oolites were replaced prior all the calcite cementation.

Plate 5.5b Transmitted light photograph illustrating carbonate allochems replaced by sphalerite, with later authigenic dolomite and quartz (2-2 Lens, W20S).



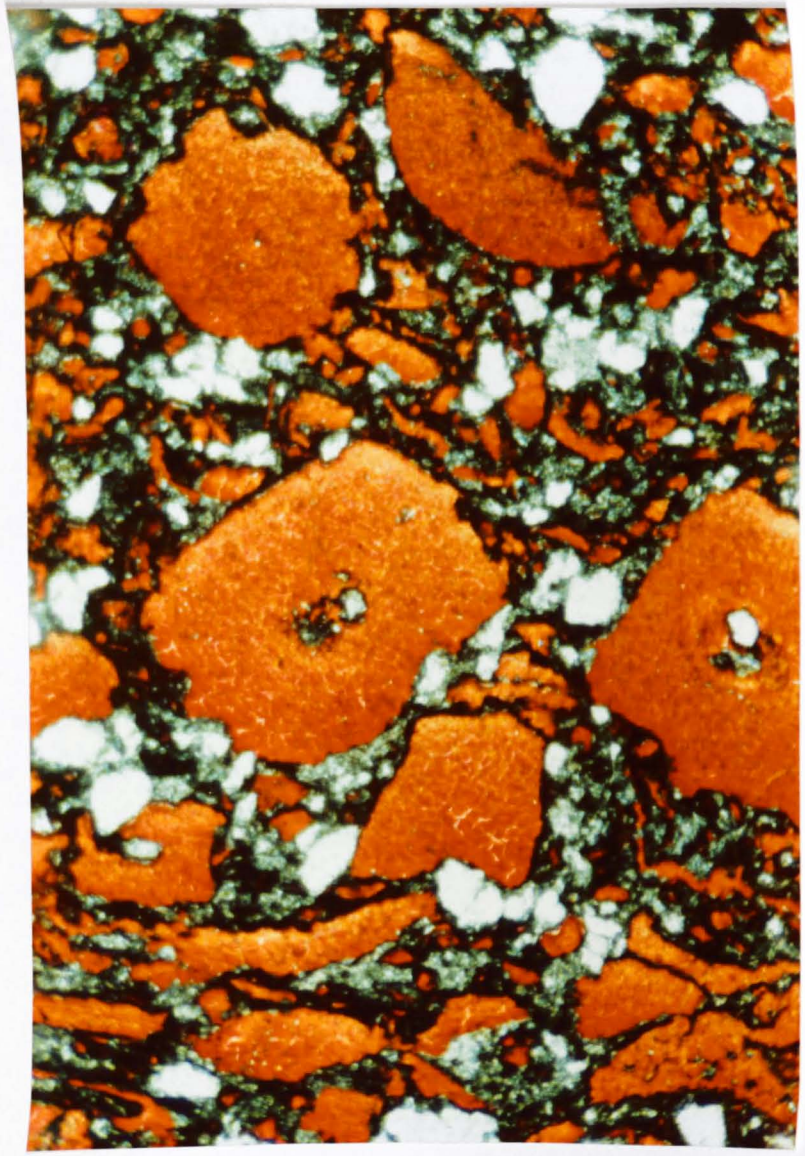
0.2mm



0.5mm

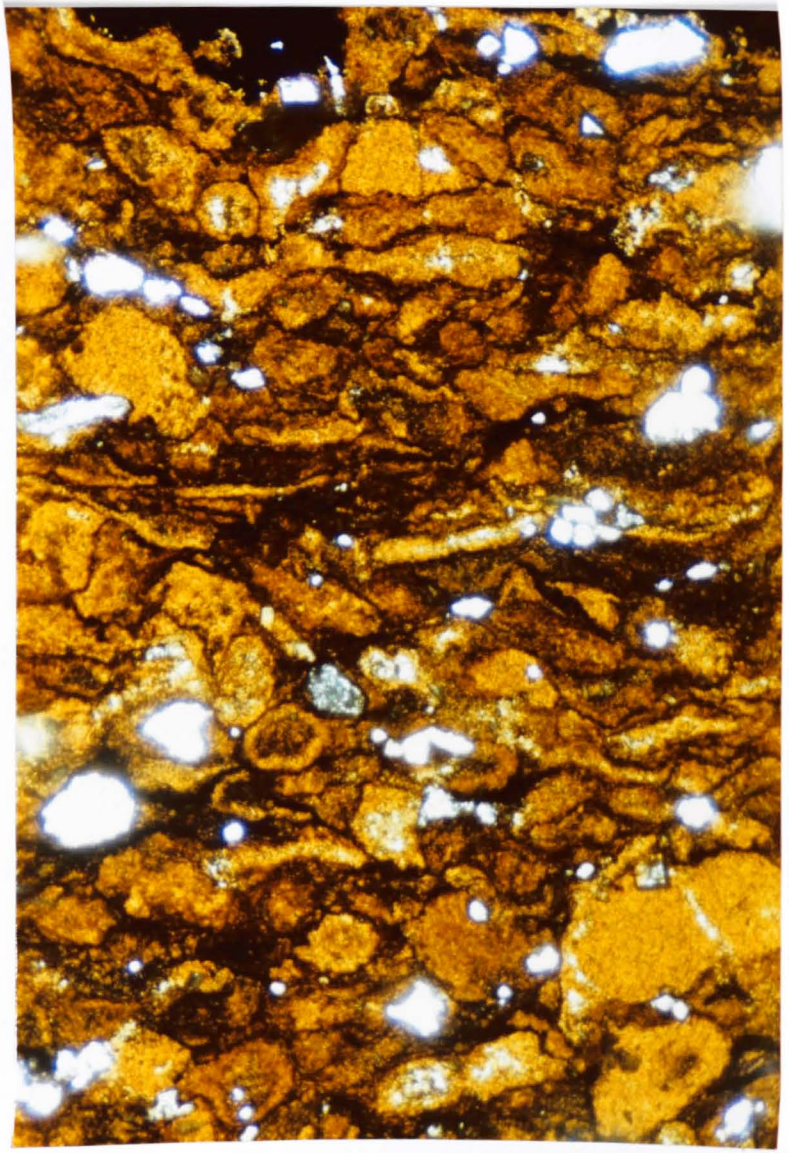
Plate 5.5c Transmitted light photograph illustrating carbonate biodebris replaced by sphalerite (2-2 Lens, W20S), with abundant pressure solution contacts between adjacent allochems.

Plate 5.5d Transmitted light photograph of a stained thin section prepared from unreplaced host rock directly above the mineralization illustrated in Plate 5.5c. Note the general absence of pressure solution contacts between the bioclasts in comparison with Plate 5.5c.



0.2mm

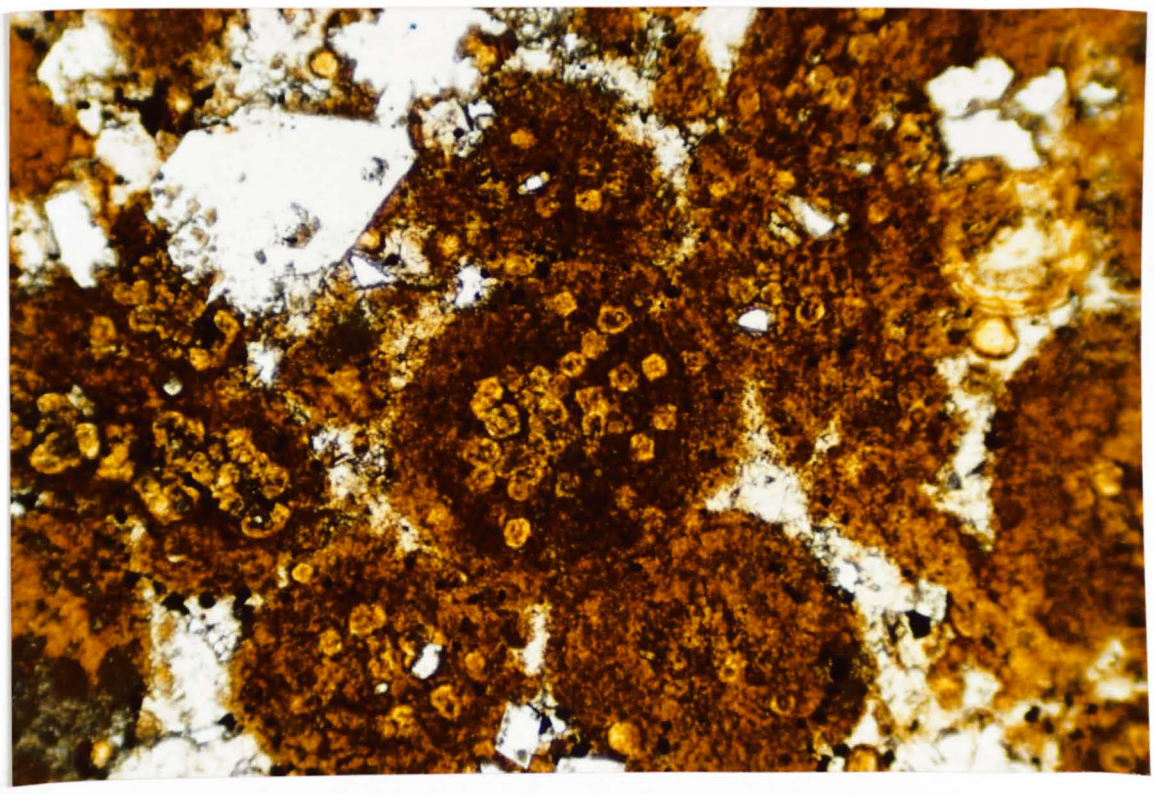
View this way



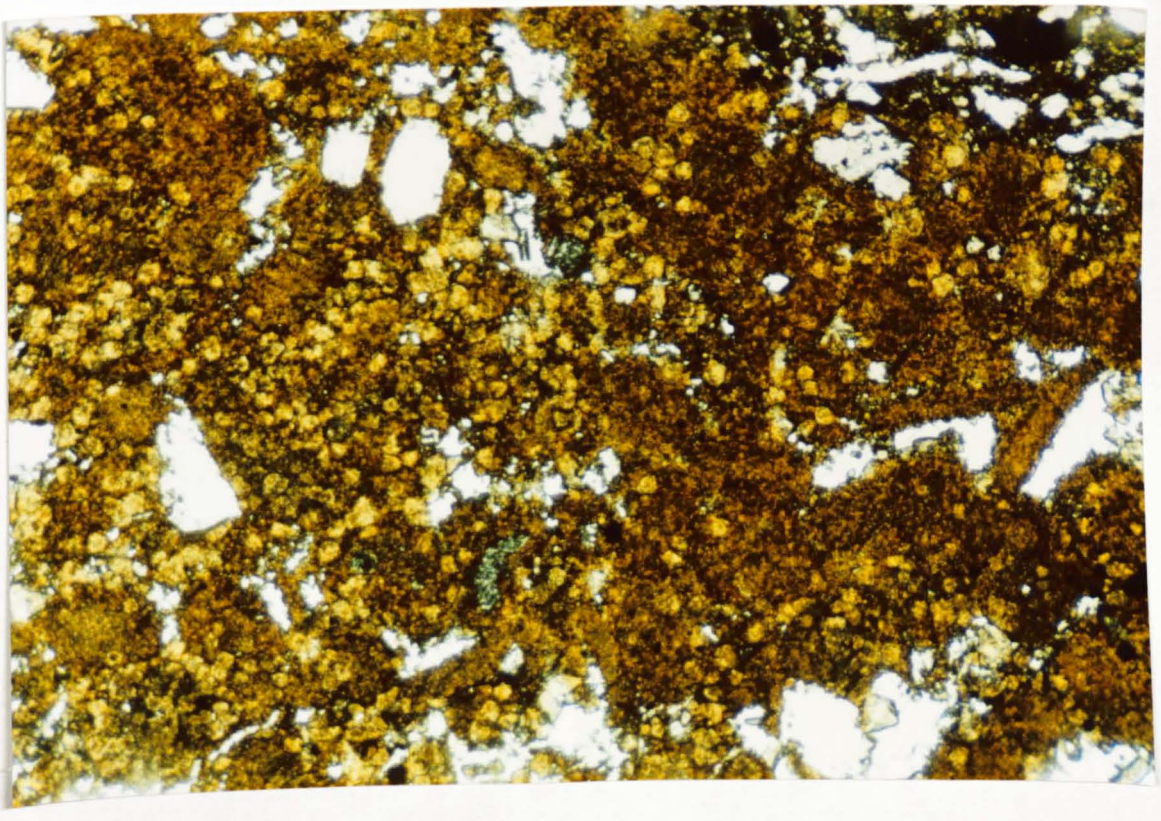
0.2mm

Plate 5.6a Transmitted light photograph illustrating sporadic development granular sphalerite on previously replaced oolites in 2-2 Lens (W20S).

Plate 5.6b Transmitted light photograph illustrating almost complete obliteration of the sphaleritized allochem texture by later granular sphalerite over-printing (2-2 Lens, W20S).



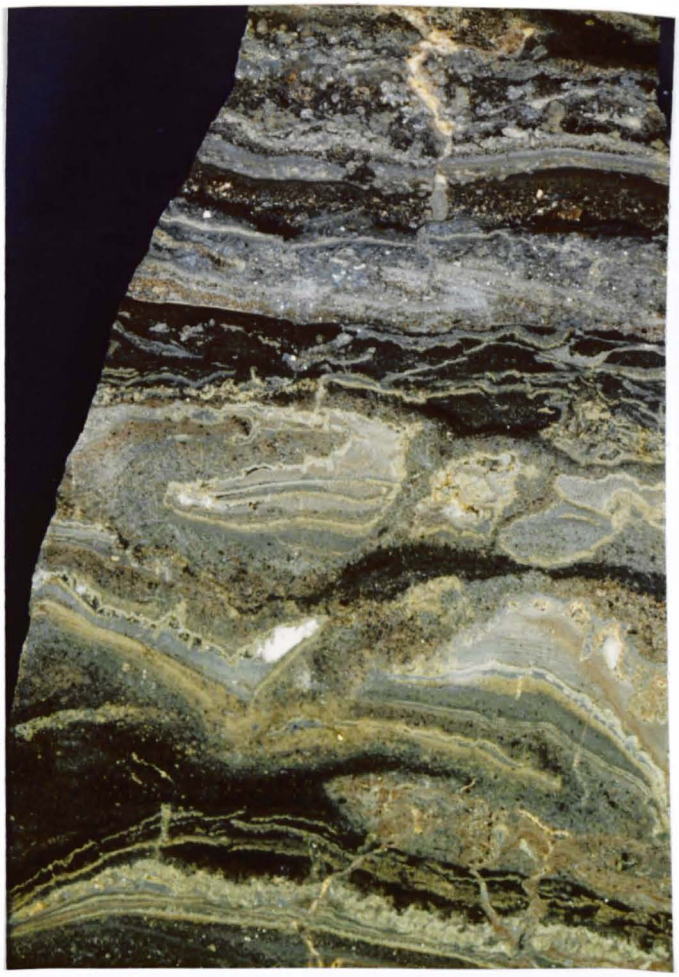
0.2mm



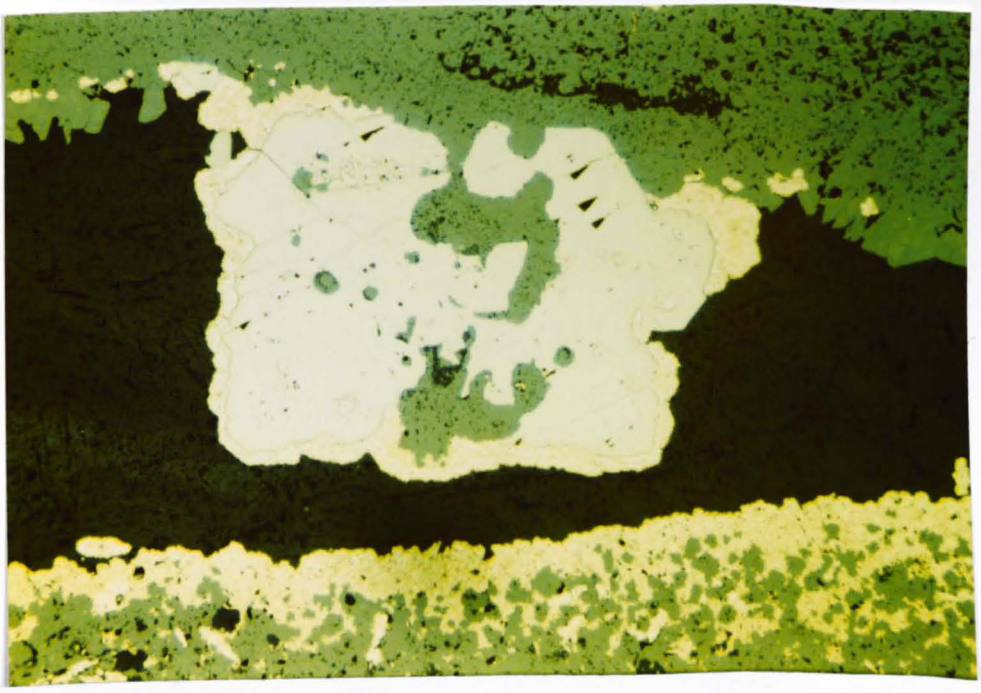
0.5mm

Plate 5.7 Photograph of a hand specimen from 2-1 Lens (206W) illustrating sulphides deposited in small, bedding-parallel cavites.

Plate 5.8 Reflected light photograph illustrating galena cubes precipitated on the top surface and sphalerite sediment below within a small, bedding-parallel cavity (2-3 Lens, 252/253S). Both are replaced by later pyrite.



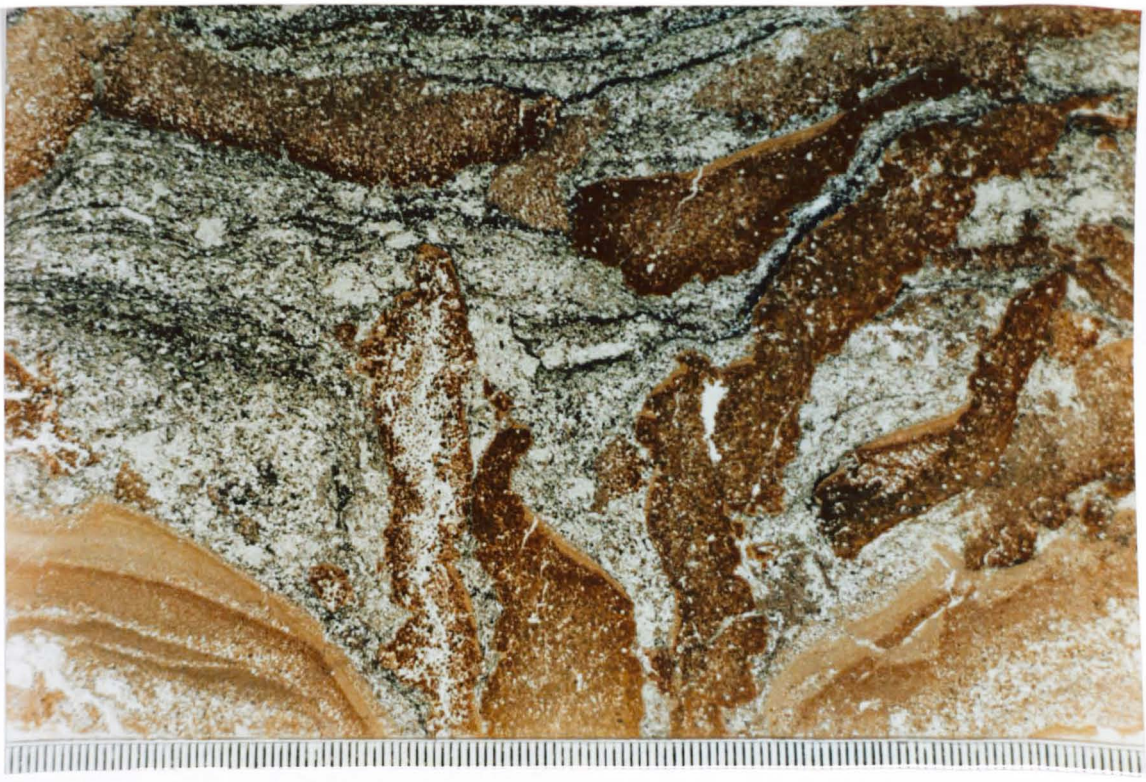
3.0cm



0.2mm

Plate 5.9 Transmitted light photograph illustrating collapsed clasts of sphaleritized allochems with later sphalerite geopetals deposited on the top surfaces of the clasts (2-3 Lens, 252/253S). Scale on the ruler is 1/2mm.

Plate 5.10 Photograph from an underground heading in 2-4 Lens (252/253S) illustrating bedding-parallel stringer veinlets directly above a massive sulphide horizon.


1cm

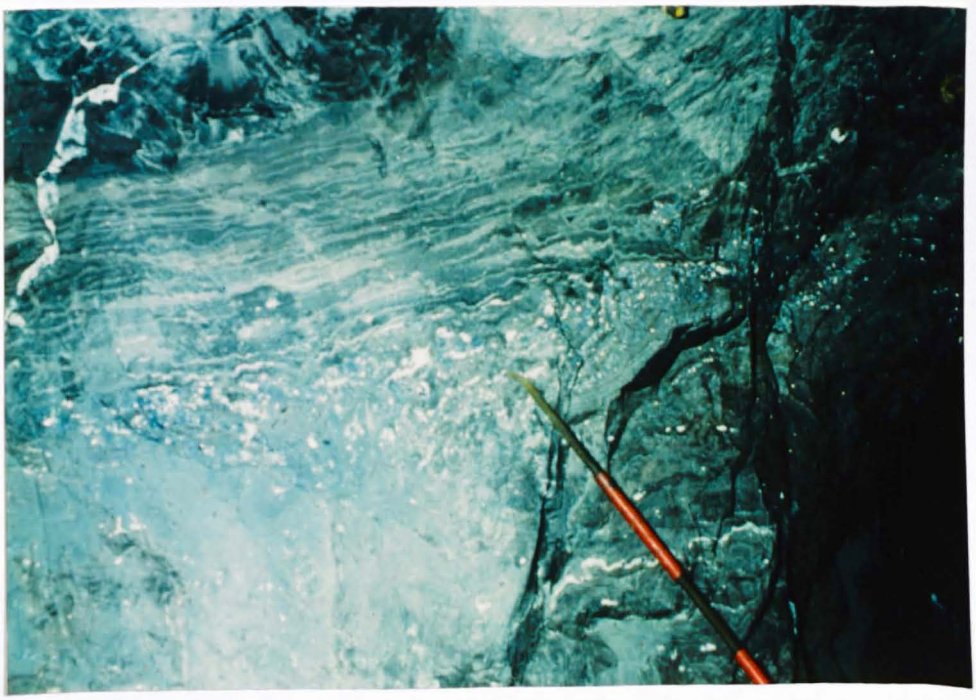
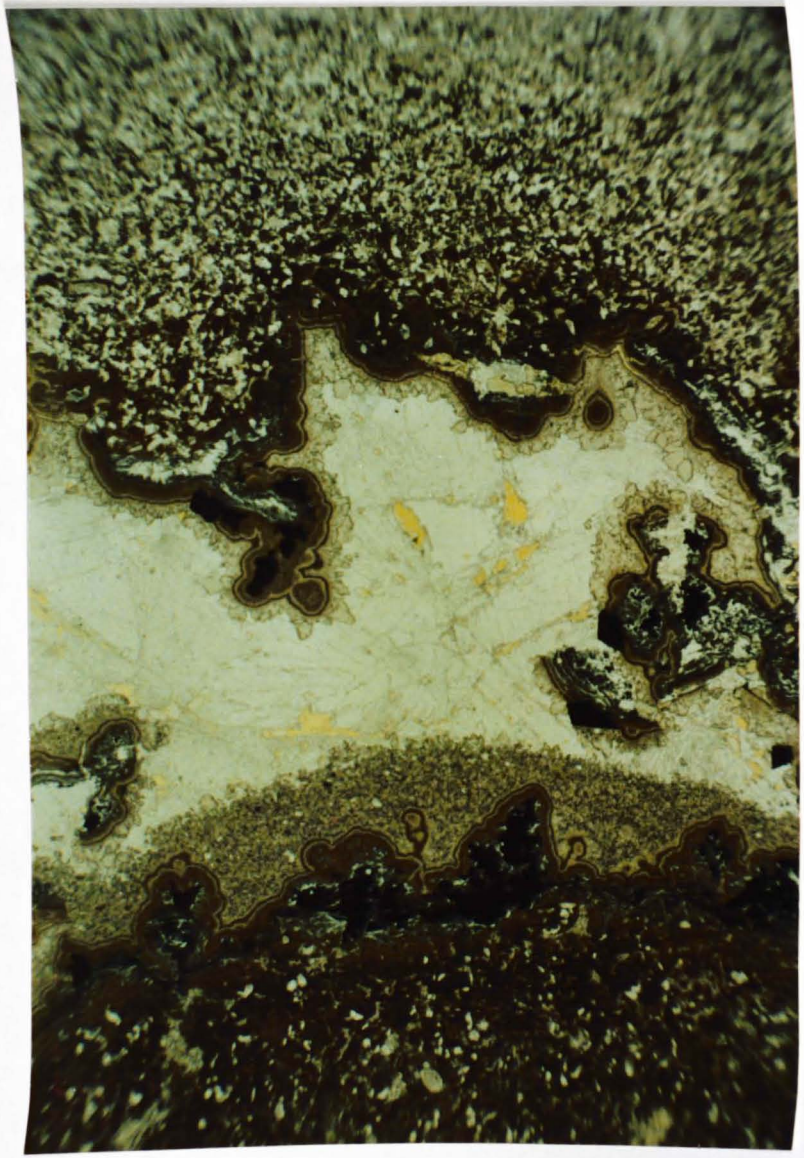


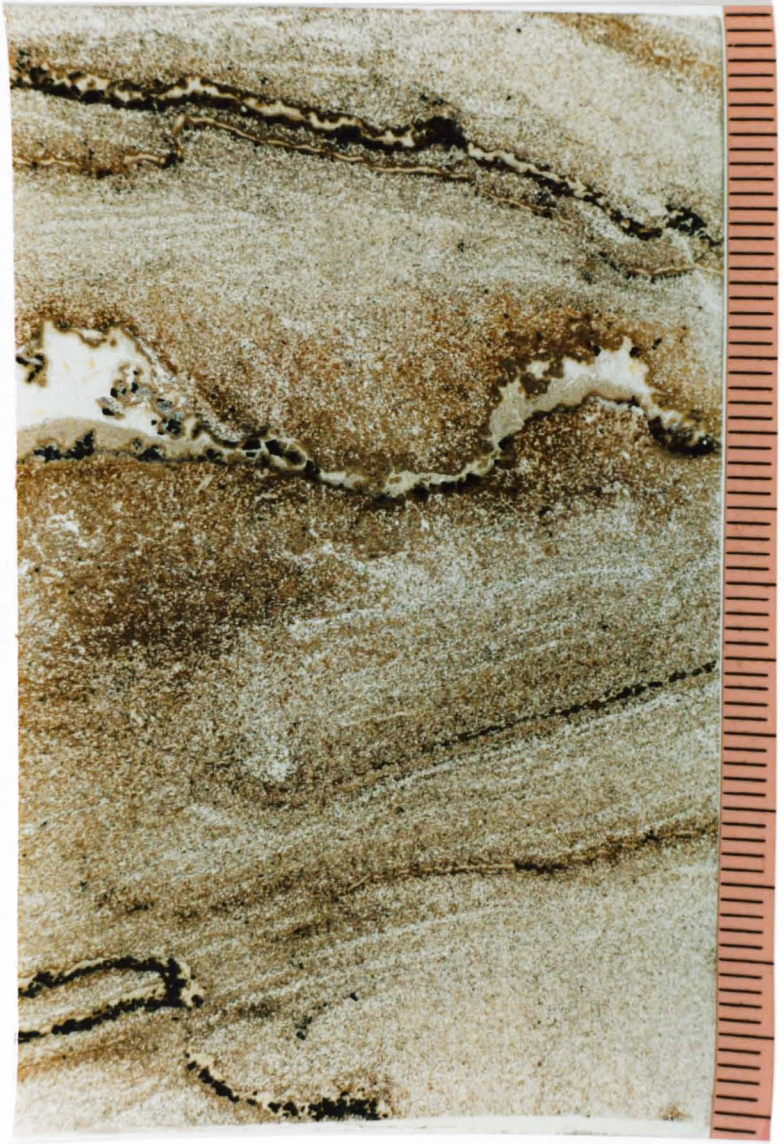
Plate 5.11a Transmitted light photograph taken across a typical stringer veinlet (2-4 Lens, 252/253S) illustrating the irregular thickening and thinning of the veinlet and also the diffuse sphalerite halo around the veinlet. Scale on the ruler is 1mm.

Plate 5.11b Transmitted light photograph of a close-up of Plate 5.11a. Note the geopetal sphalerite below the white barite.



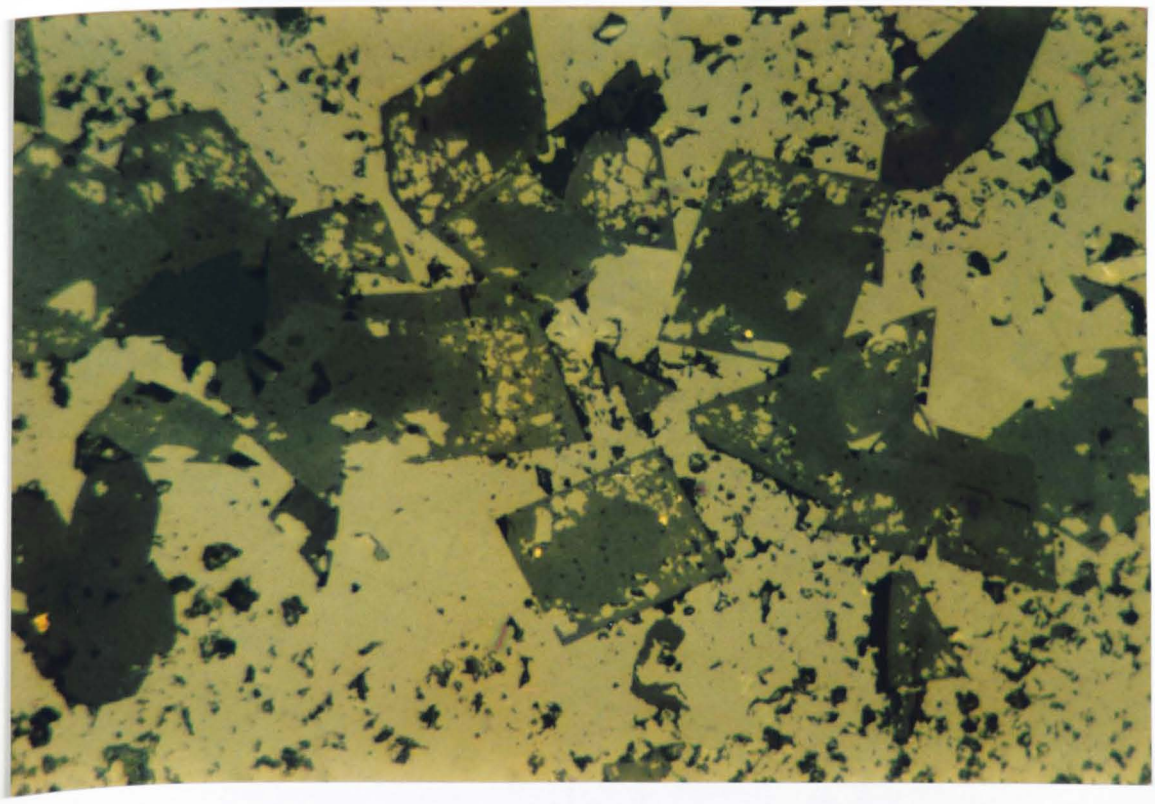
4mm

View this way



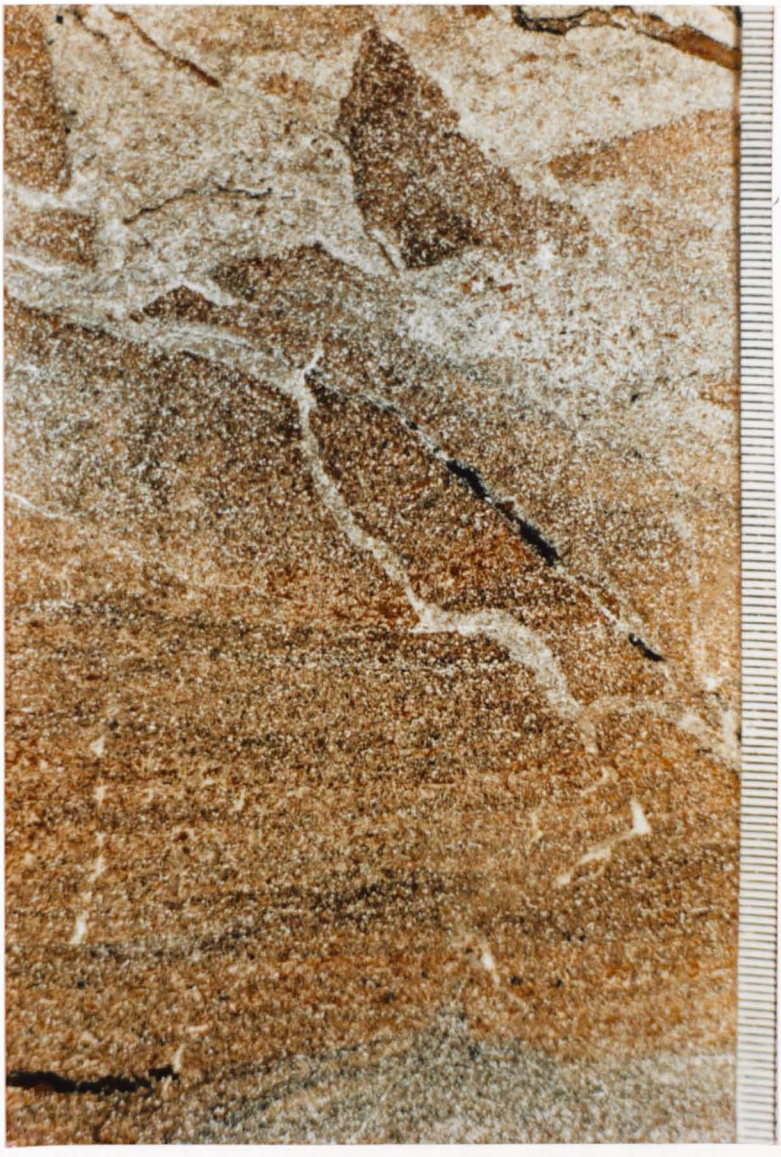
1cm

Plate 5.11c Reflected light photograph illustrating sphalerite inclusions confined to the outermost areas of authigenic dolomite rhombs (2-4 Lens, 252/253S).



0.2mm

Plate 5.12 Transmitted light photograph illustrating *in-situ* disrupted clasts of sphalerite-rich mineralization from the bedding-parallel, stringer sulphides (2-4 Lens, 252/253S). Scale on the ruler is 1/2mm.



1cm

Plate 5.13a Photograph from an underground heading in 2-2 Lens (W40S) illustrating coarse galena exhibiting a contorted texture within massive sulphides.

Plate 5.13b Photograph from the same heading as that in Plate 5.13a illustrating bedding-parallel, layered coarse galena.

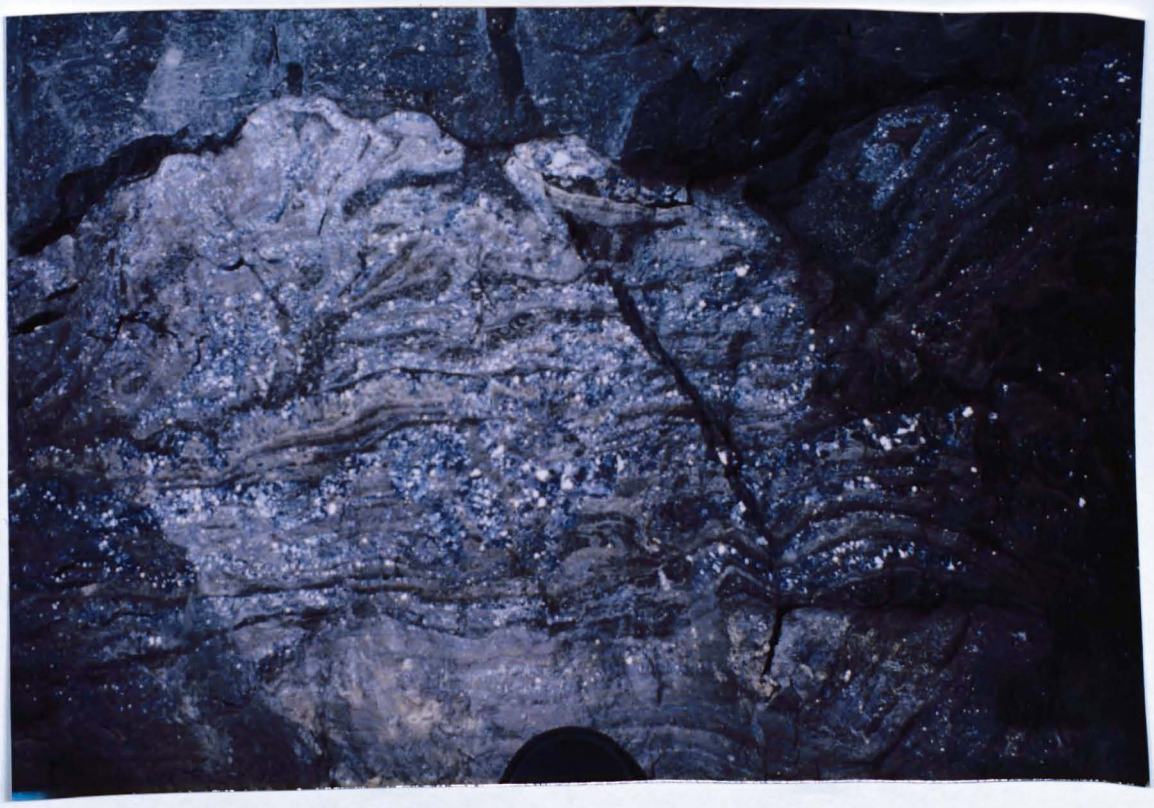


Plate 5.14 Transmitted light photograph illustrating ghost oolitic structures within barite (2-2 Lens, W25S).

Plate 5.15 Photograph of a hand specimen from 2-1 Lens (229N) illustrating coarse bladed galena precipitated within a bedding-parallel vein, and clearly showing the direction of galena growth.


0.5mm

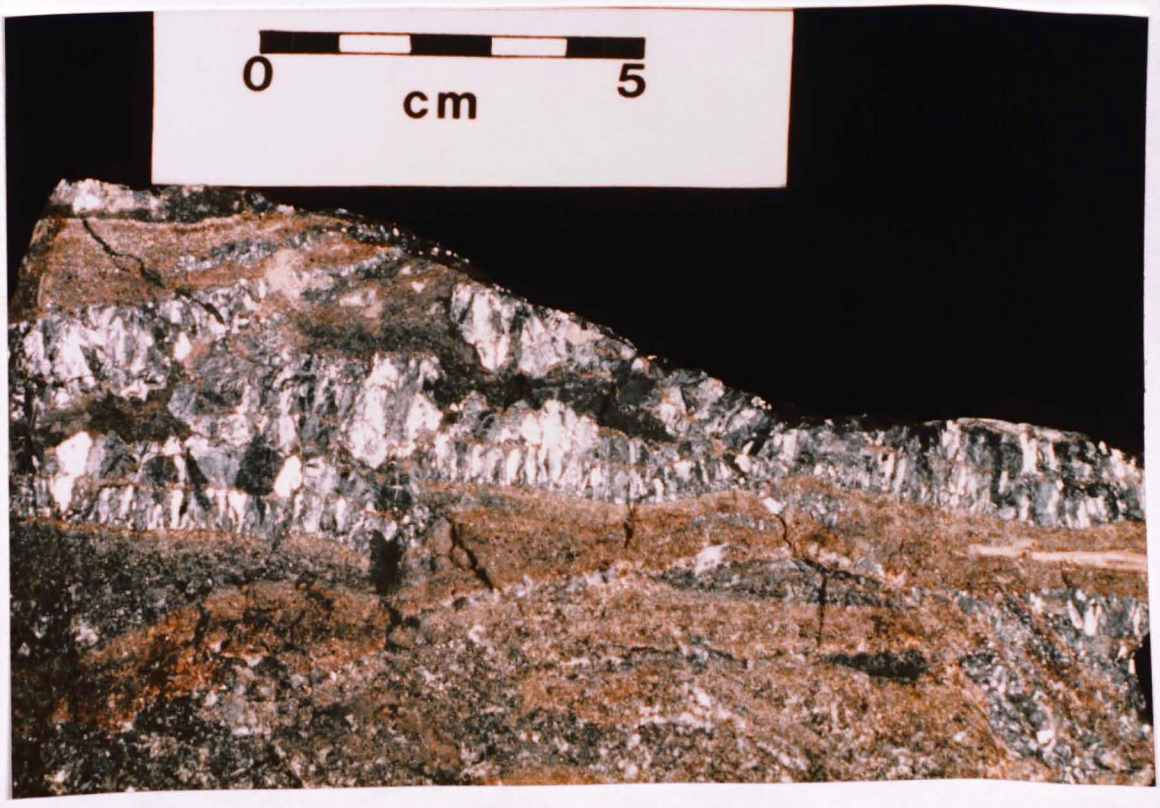
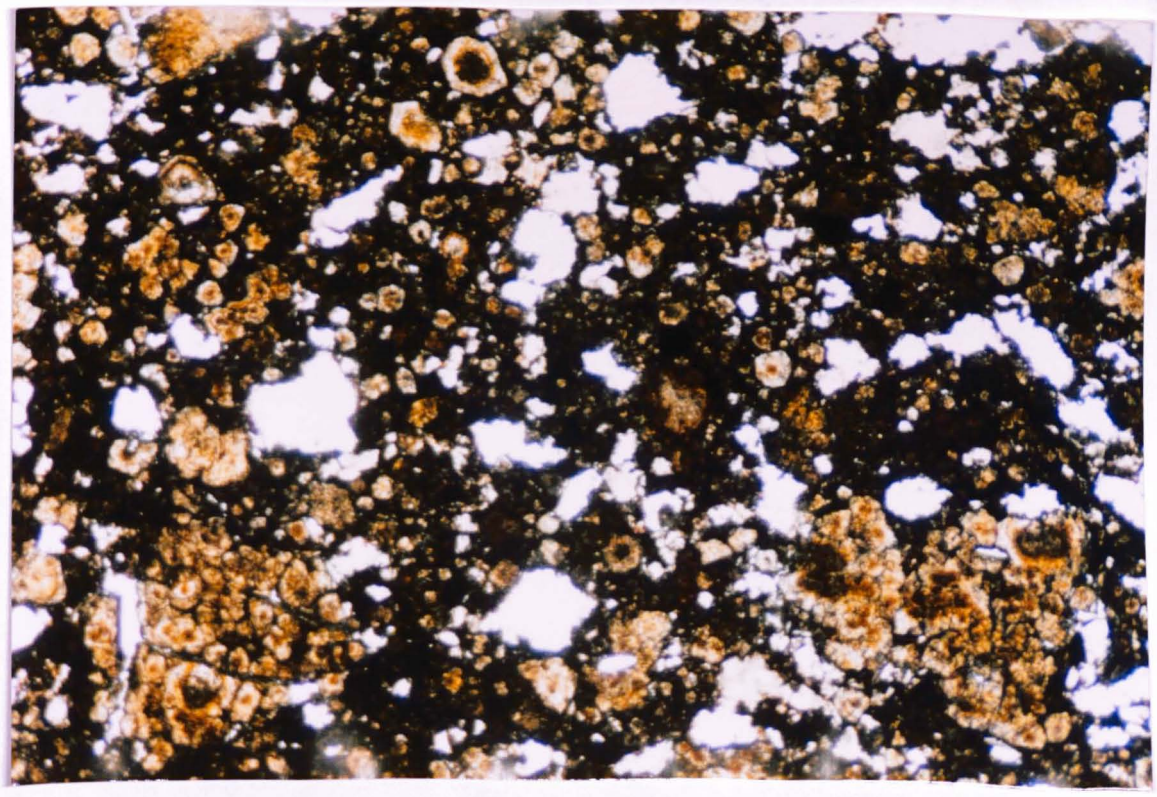
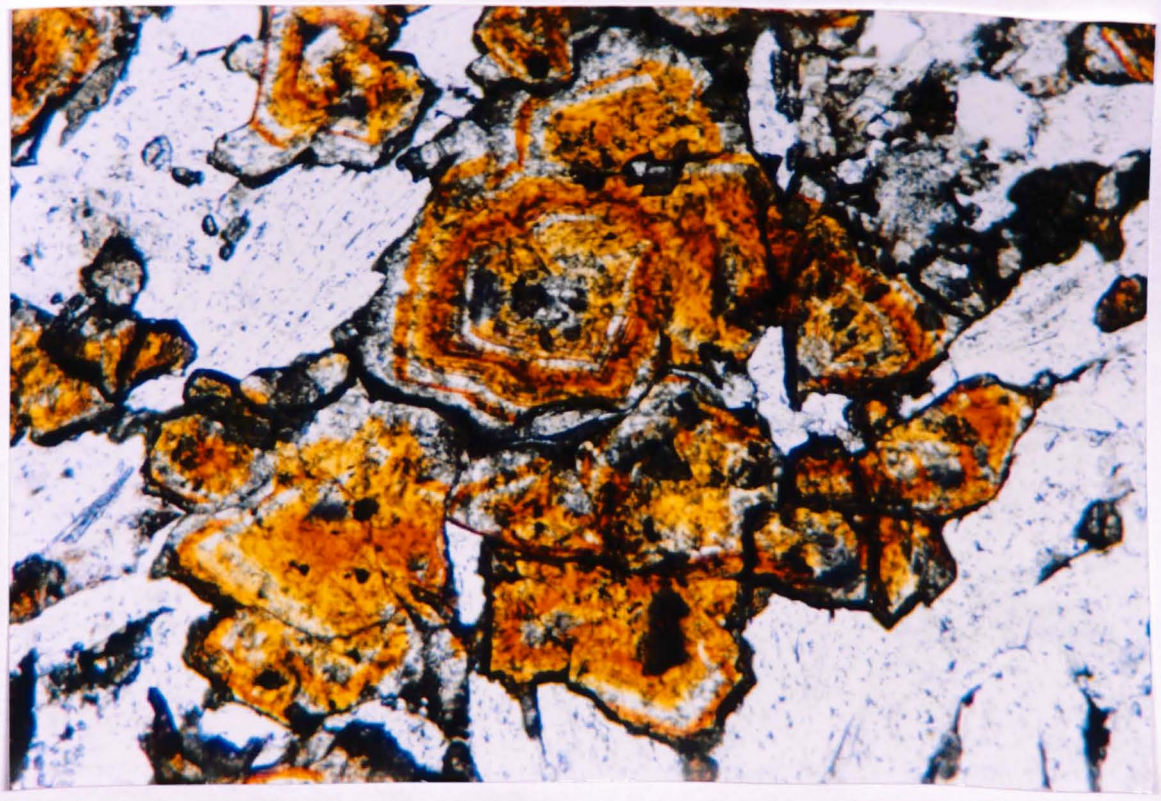

0
cm
5

Plate 5.16a Transmitted light photograph illustrating granular sphalerite with sporadic development of zoned sphalerite crystals (2-2 Lens, W25S).

Plate 5.16b Transmited light photograph illustrating a well-zoned sphalerite crystal (2-2 Lens, W25S).



0.5mm

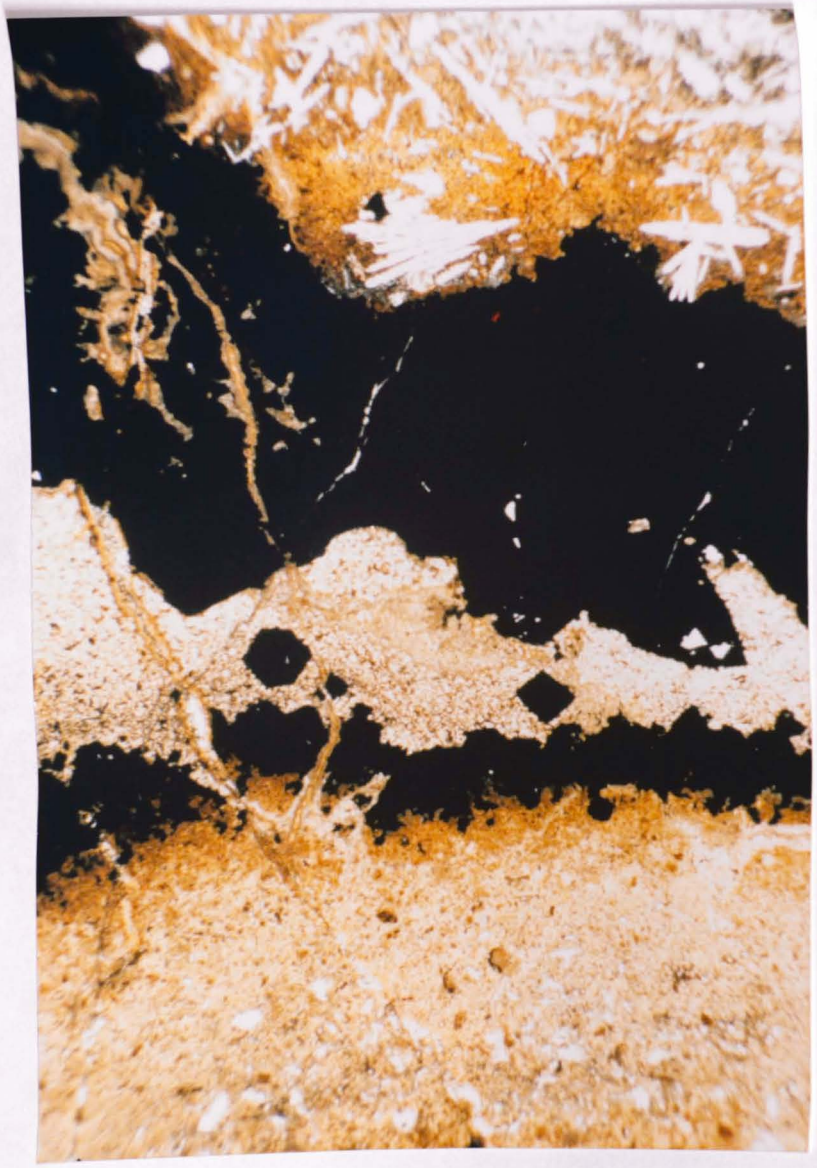


0.2mm

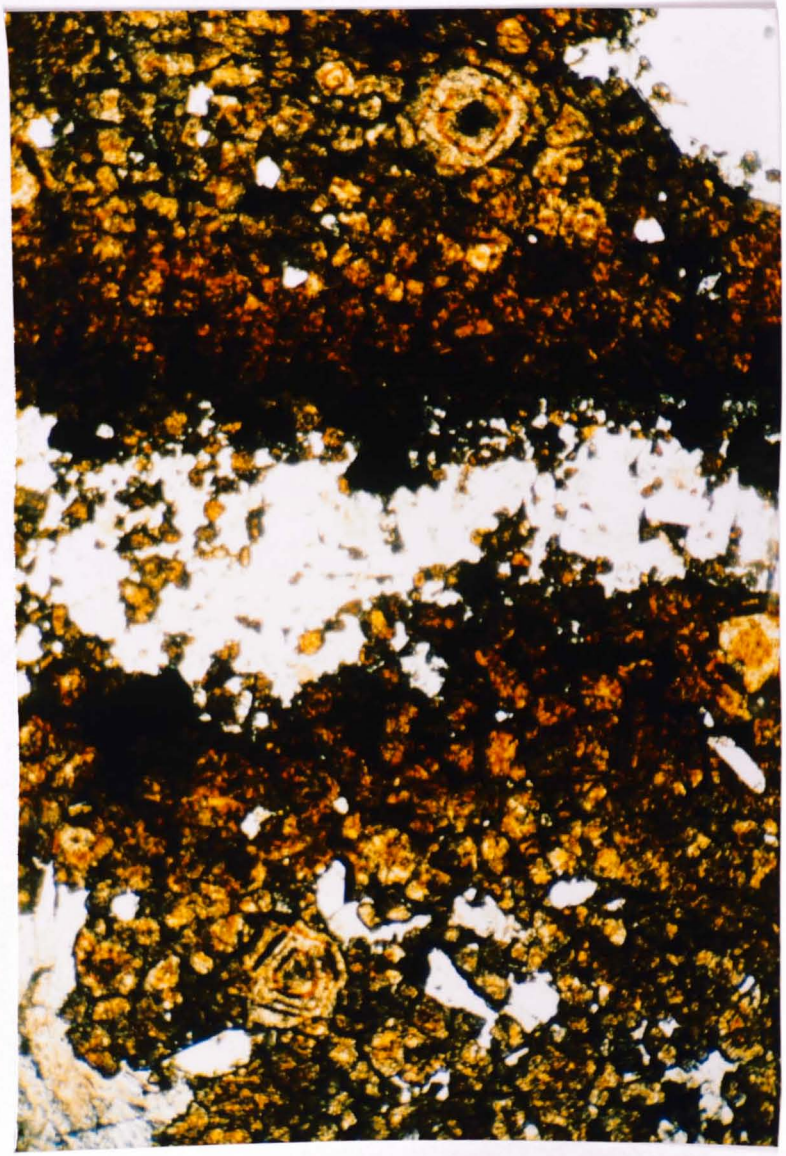
Plate 5.16c Transmitted light photograph illustrating zoned sphalerite crystals adjacent to the base of a galena band (2-5 Lens, 1190 haulage).

Plate 5.16d Transmitted light photograph illustrating an orange/red halo developed within the sphalerite adjacent to the base of a galena band (2-2 Lens, W35S).

View this way



3mm



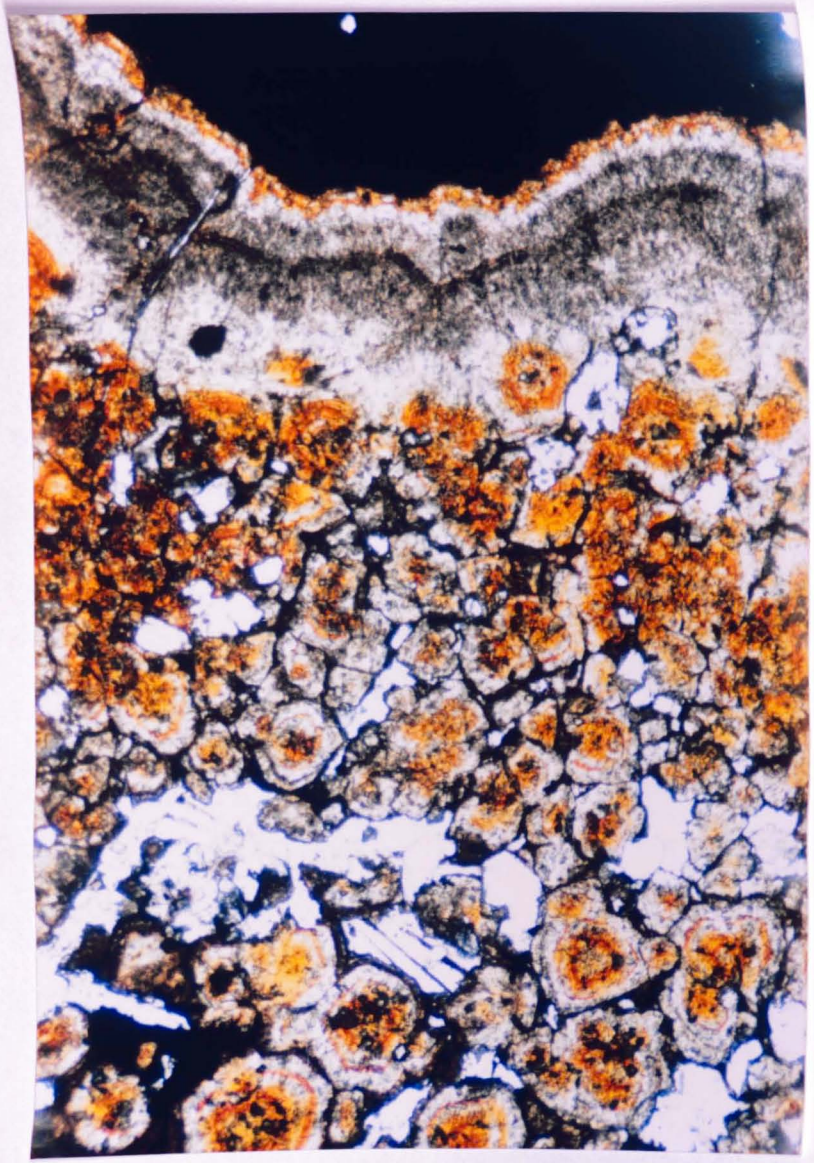
0.5mm

EW

Plate 5.16e Transmitted light photograph illustrating a series of galena/sphalerite layers deposited on the base of a bedding-parallel cavity in 2-2 Lens (W20S) with orange haloes in the sphalerite directly below each galena band.

Plate 5.17 Transmitted light photograph illustrating zoned sphalerite crystals which pass transitionally into a more crustiform sphalerite growth below a galena band (2-2 Lens, W25S). The sphalerite generations in both styles are the same. The thin orange zone at the top of the crustiform growth is the same as that observed within the sphalerite crystals.

View this way



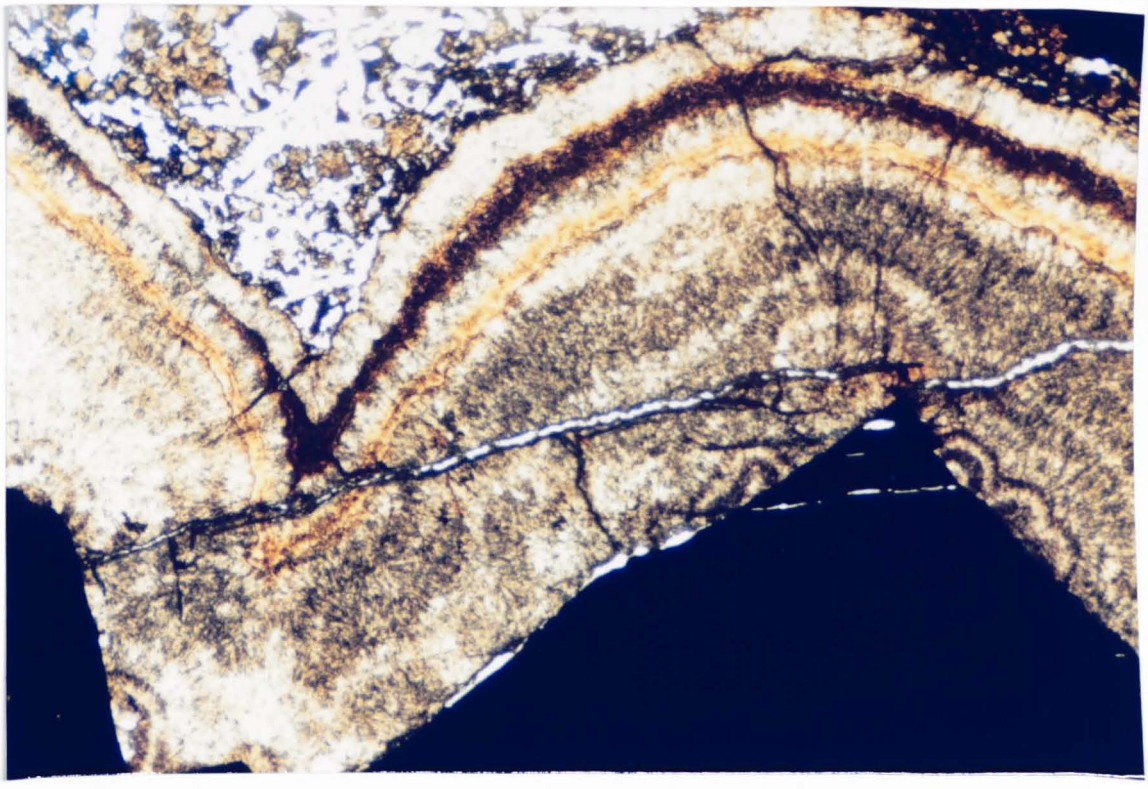
0.5mm

3mm

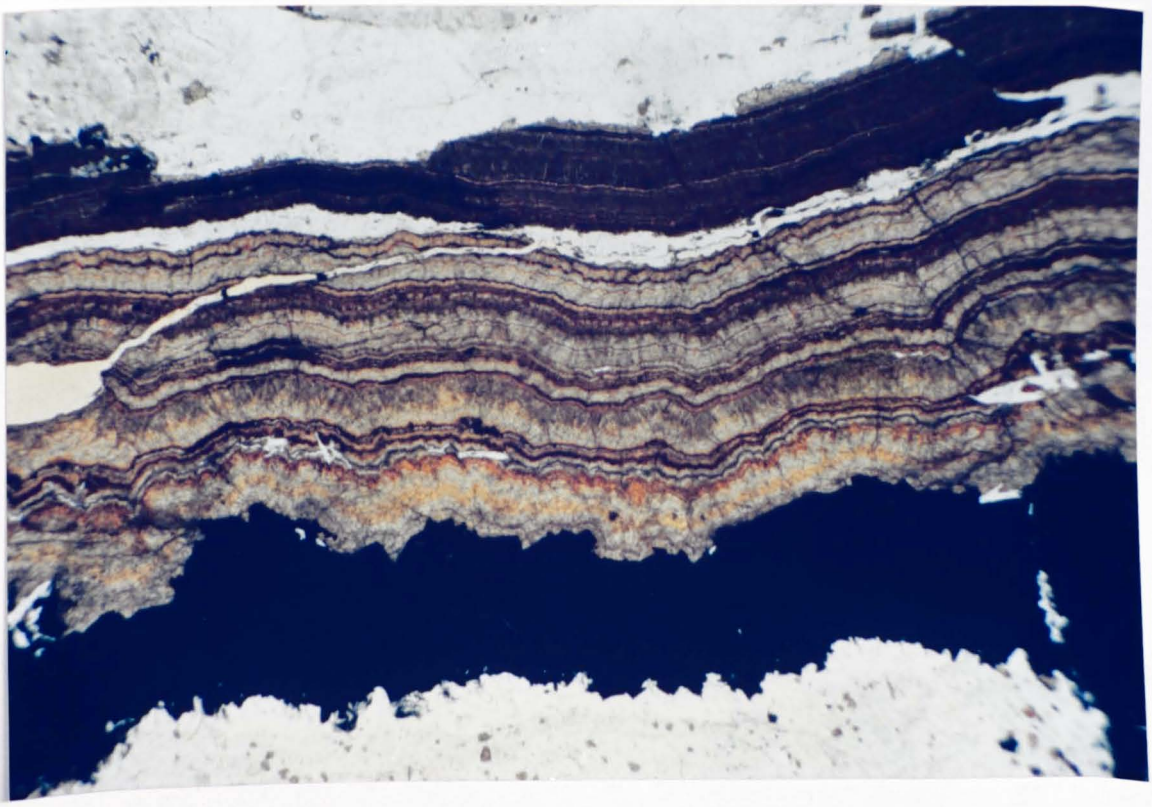
445

Plate 5.18a Transmitted light photograph illustrating crustiform to rhythmically banded sphalerite overgrowths deposited on top of a coase galena band (2-2 Lens, W25S).

Plate 5.18b Transmitted light photograph illustrating fine rhythmically banded sphalerite overgrowths on coarse bladed galena in 2-5 Lens (242S).



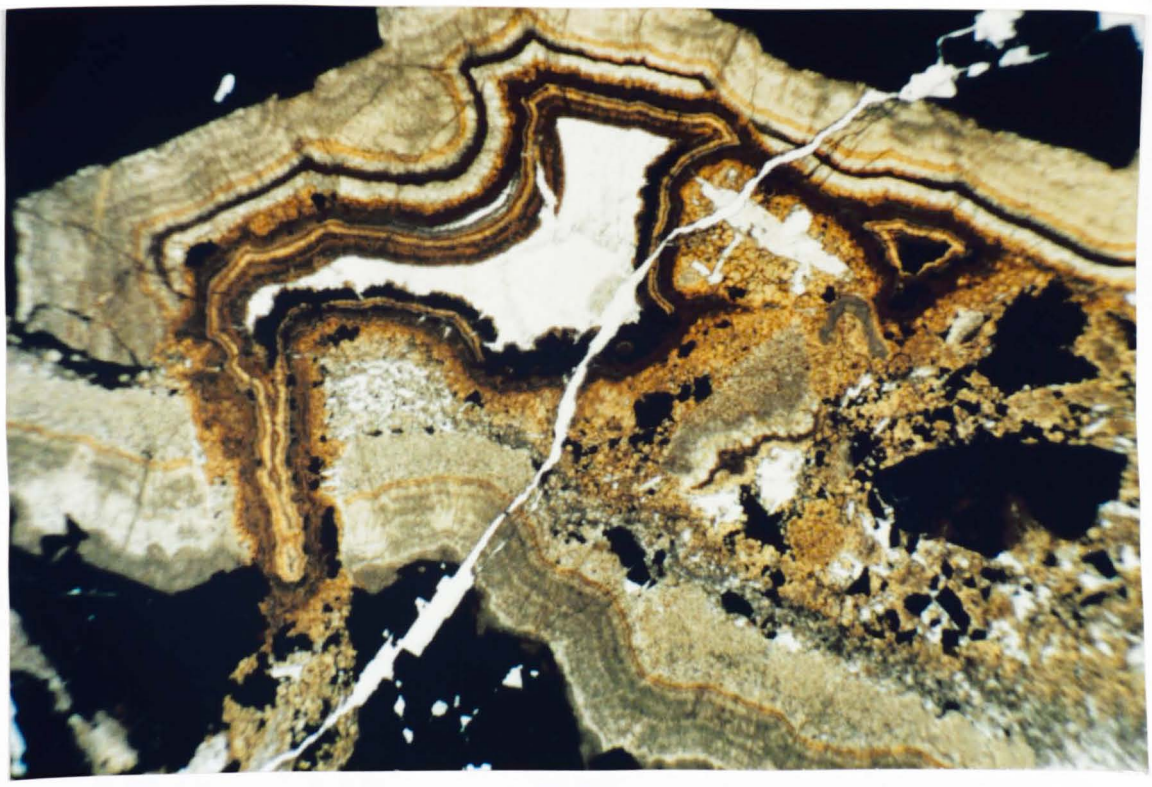
0.2mm



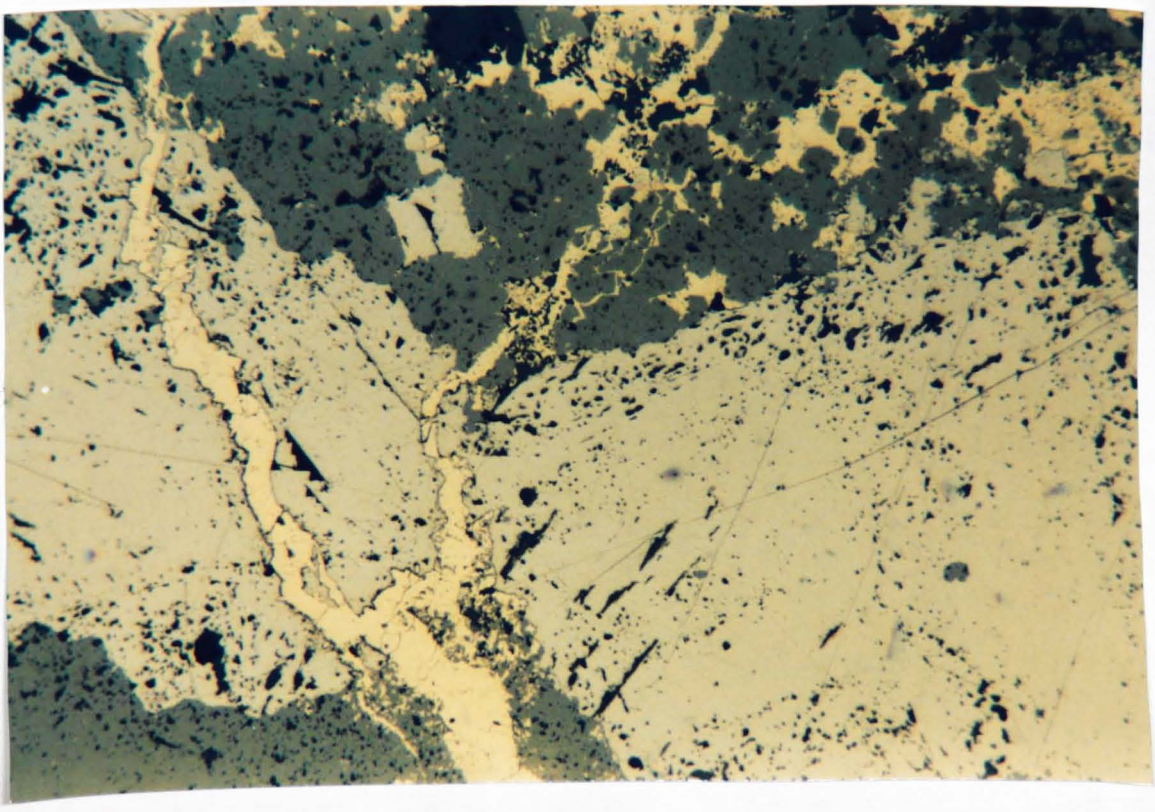
2mm

Plate 5.18c Transmitted light photograph illustrating a dissolutional contact between two generations of rhythmically banded sphalerite in 2-2 Lens (W25S).

Plate 5.19 Reflected light photograph illustrating late-stage pyrite deposited in fractures cross-cutting earlier galena bands (2-2 Lens, W35S).

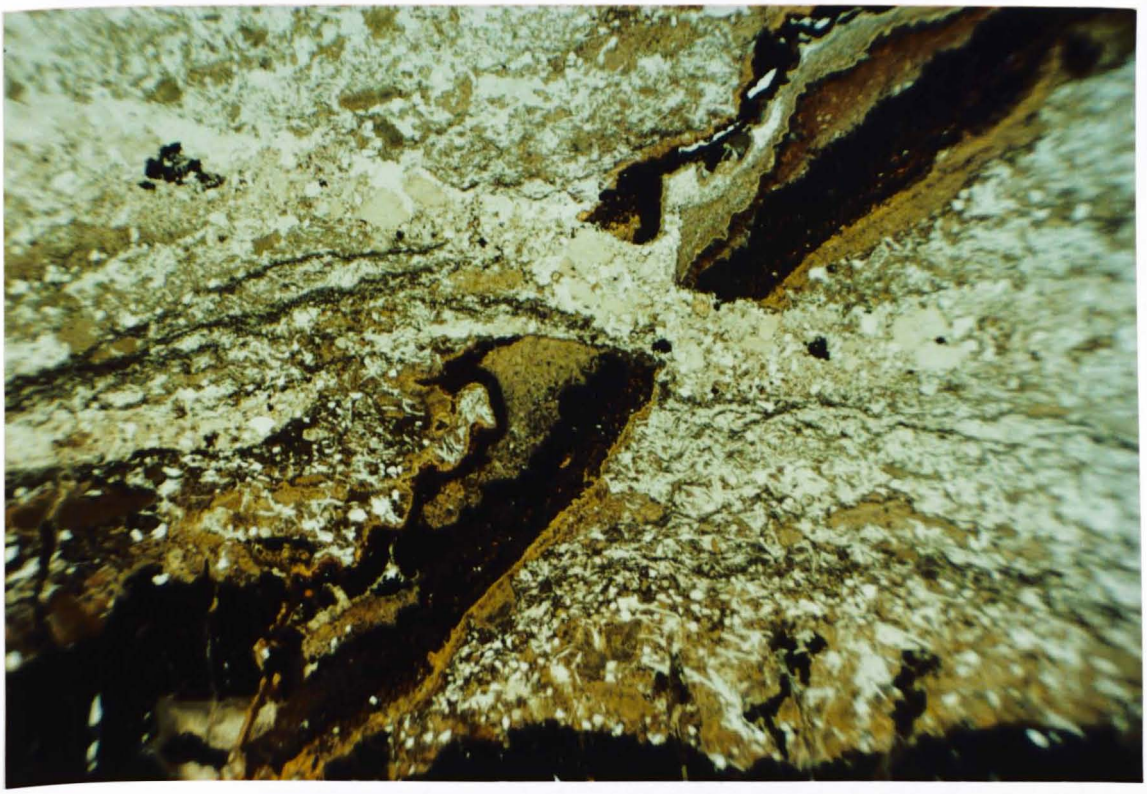


1mm



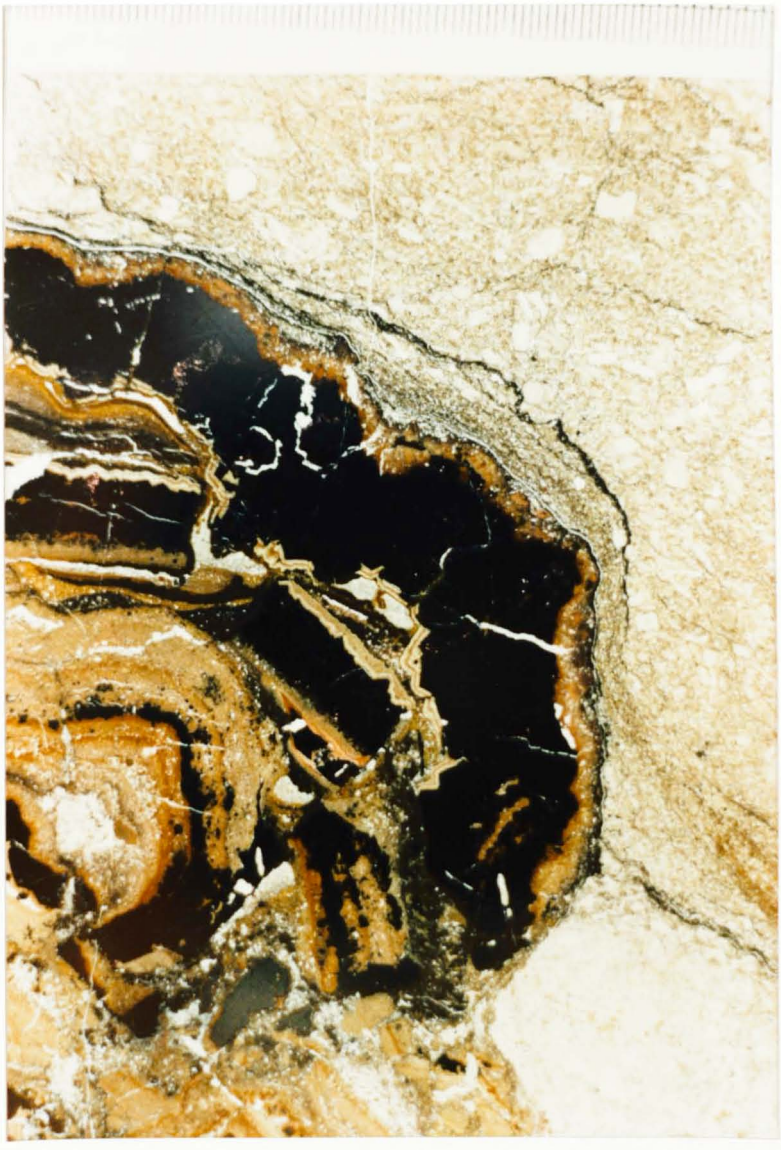
0.2mm

Plate 5.20 Transmitted light photograph illustrating a "dyke" containing carbonate biodebris cutting galena and sphalerite within a massive sulphide horizon (2-2 Lens, W35S).



4mm

Plate 5.21a Transmitted light photograph illustrating a thin pressure solution seam in the Nodular Marker, deformed by/around a coarse galena layer at the hanging wall (2-2 Lens, W40S). Scale on the ruler is 1/2mm.



1cm

Plate 5.21b Transmitted light photograph of a close-up of the pressure solution seam illustrated in Plate 5.21a.

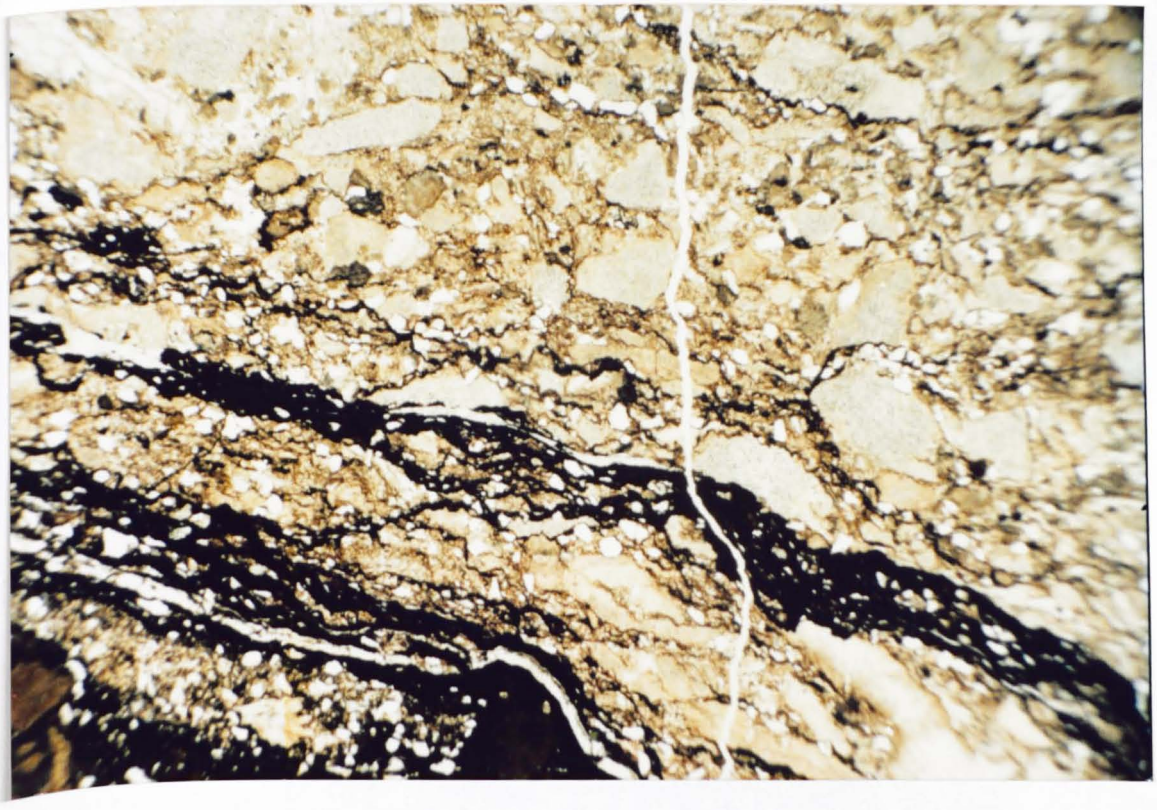
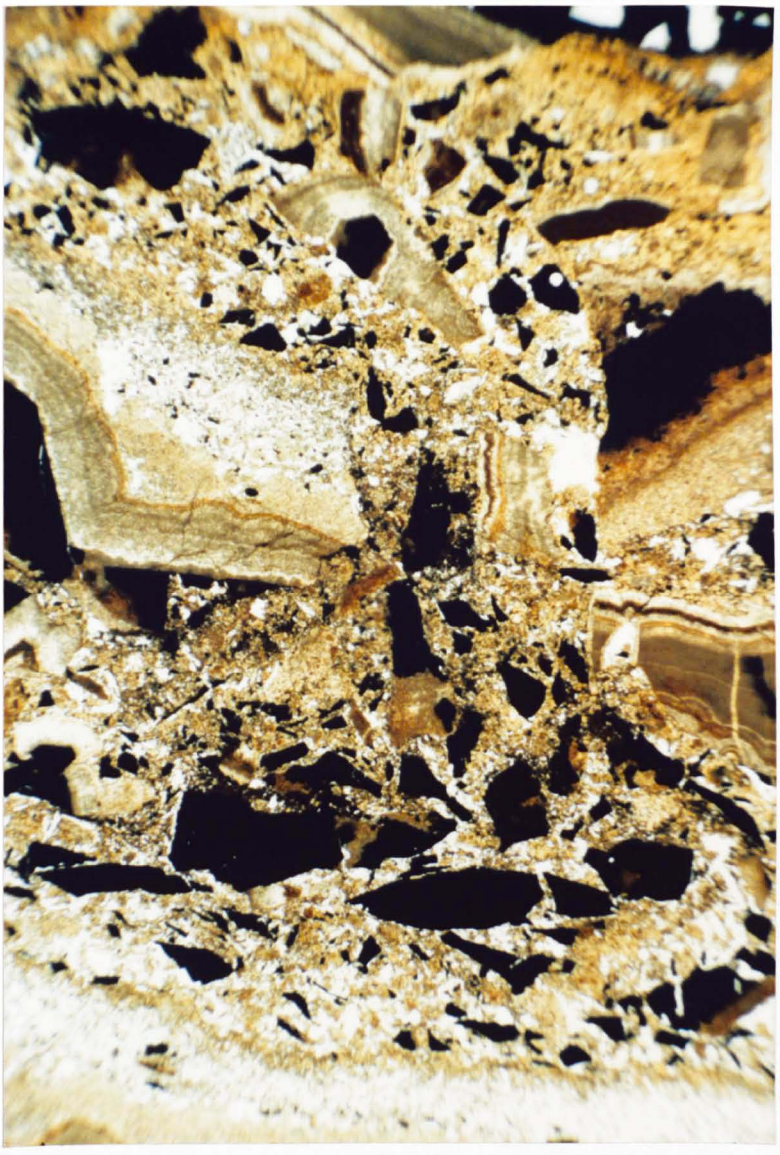

1mm

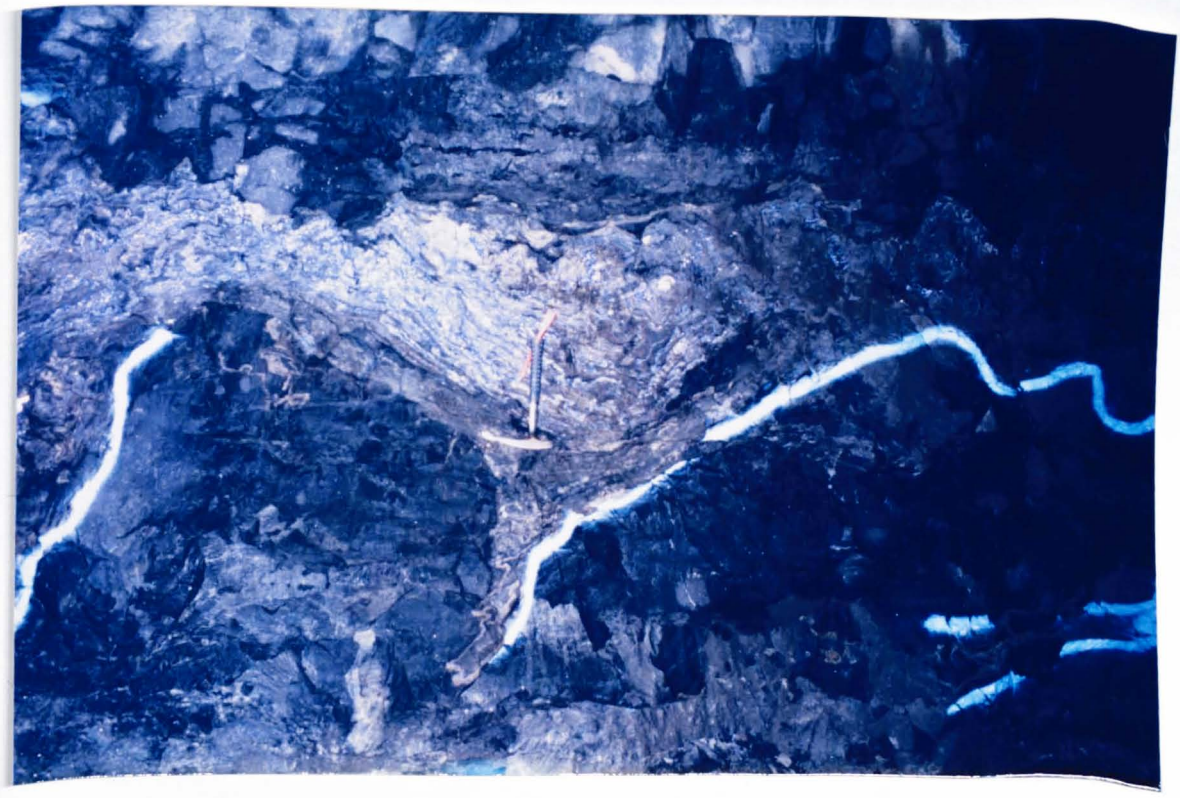
Plate 5.22 Transmitted light photograph illustrating a brecciation or "splintering" of coarse bladed galena in 2-2 Lens (W25S).



2mm

Plate 5.23a Photograph from an underground heading in 2-2 Lens (W40S) illustrating a funnel structure in the sulphide horizon. Note the layering within the galena on the left hand side only and the layering in the sphalerite below which can be traced across the stucture. Also note the thickening of the sphalerite layer in the nose of the closure at the base of the funnel. Hammer for scale.

Plate 5.23b Photograph from an underground heading in 2-2 Lens (W35S) illustrating a funnel structure with some layering in the sphalerite, contorted (slumped) galena and late-stage laminated pyrite. Hammer for scale.



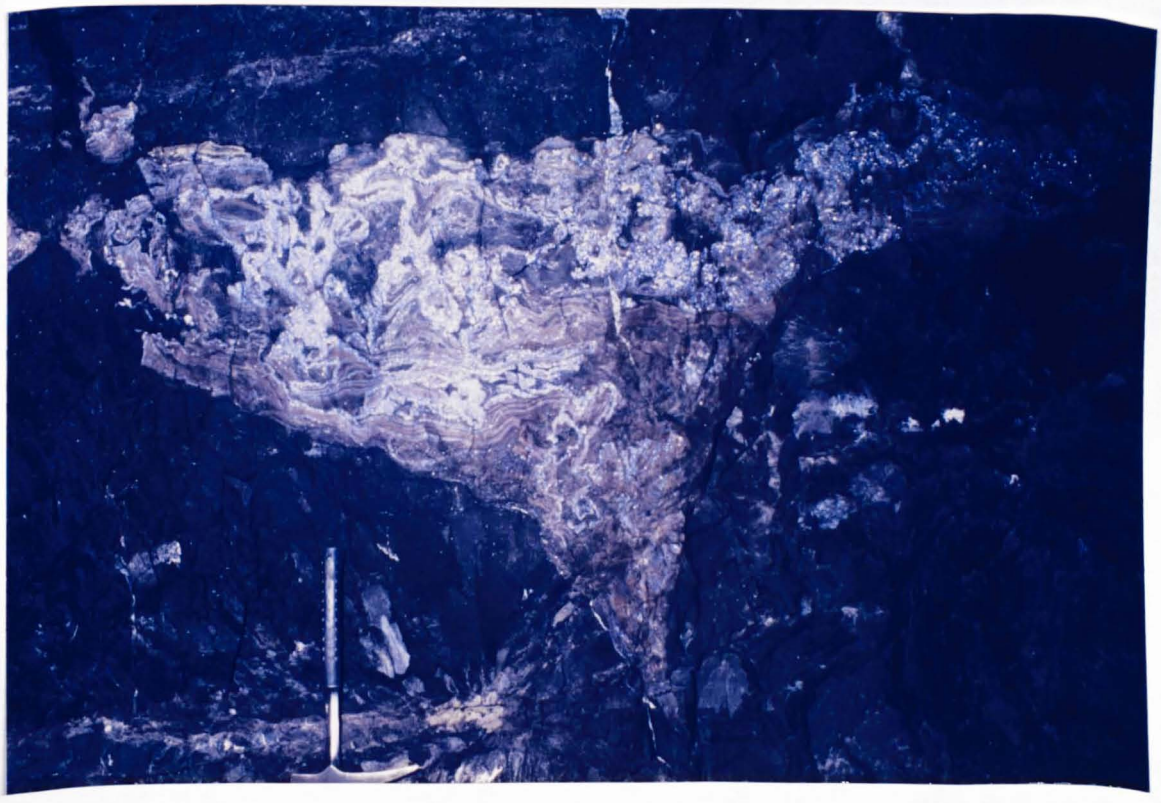


Plate 5.24a Photograph from an underground heading in 2-1 Lens (222W) illustrating a high-grade bedding-parallel sulphide horizon formed at the contact between a darker calcarenite and an overlying, lighter-coloured dolomite. Hammer for scale.

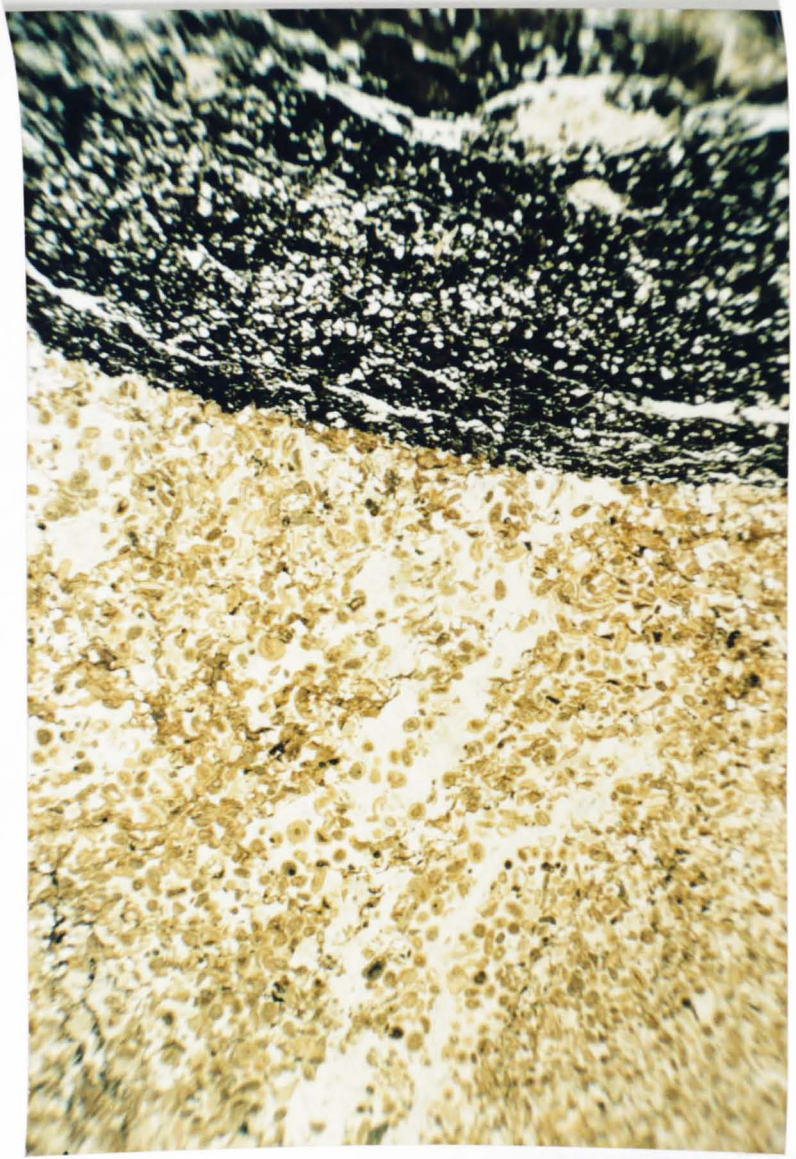
Plate 5.24b Photograph from an underground heading in 2-1 Lens illustrating the contact between a bioclastic calcarenite (biodebris sparkling in the light) and an overlying silty dolomite, with sulphides deposited at the contact. Field of view is 2.5m across.

Plate 5.25 Photograph from an underground heading in 2-1 Lens (222W) illustrating dark argillite with lesser disrupted sphalerite layers at the base of a sulphide horizon. Lens cap for scale.

Plate 5.26 Transmitted light photograph illustrating a sharp, dissolutional between dark argillite and an underlying oolitic calcarenite in the footwall of 2-3 Lens. The oolites at the contact often have dissolved margins.

Plate 5.27a Photograph from an underground heading in 2-3 Lens (252/253S) illustrating layered, internal sphalerite sediment exhibiting growth folding at the top of the sulphide horizon. Hammer for scale.

View this way



3mm

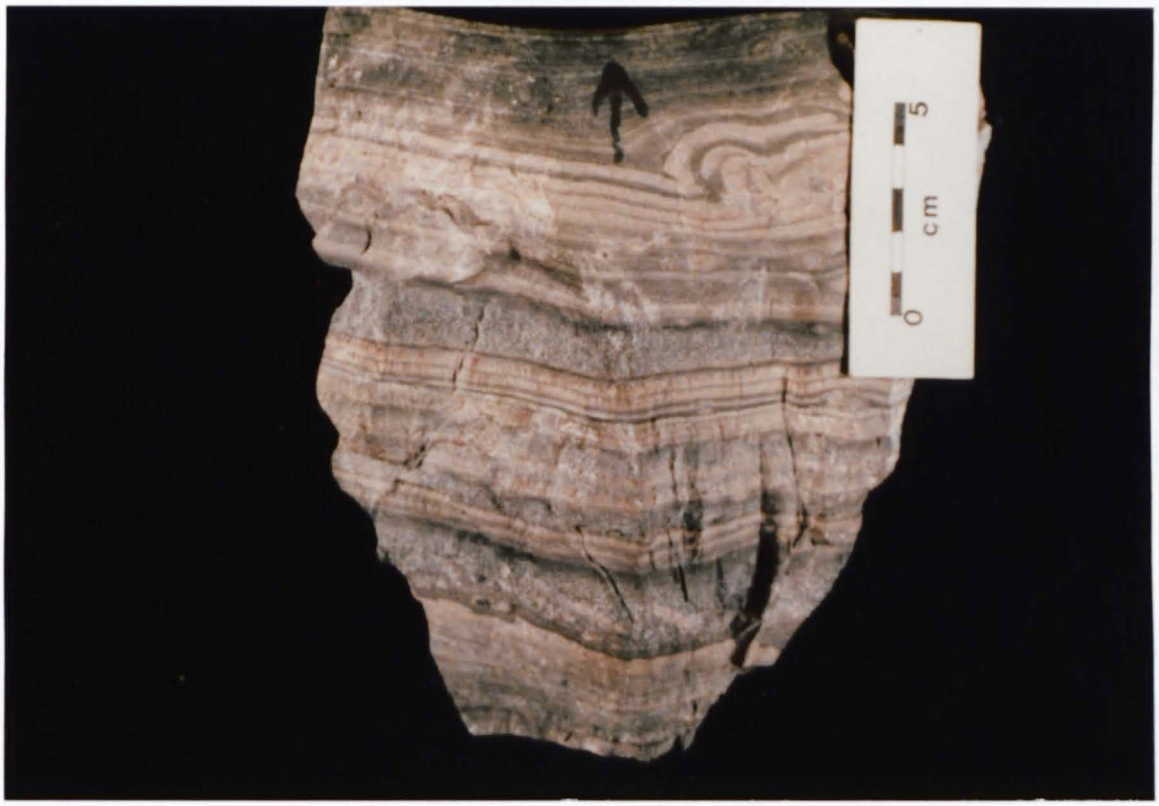
Plate 5.27b Photograph from an underground heading in 2-4 Lens (252/253S) illustrating, layered (sloppy) internal sphalerite sediment at the base of a sulphide horizon.

Plate 5.27c Photograph of drillcore illustrating layered, graded, internal sphalerite sediment in 1-5 Lens.

View this way

Plate 5.28a Photograph of a hand specimen from 2-1 Lens (226N) illustrating layered, graded internal sphalerite sediment interbedded with detrital silt-rich horizons.

Plate 5.28b Photograph of a hand specimen from the exposure illustrated in Plate 5.27b, illustrating layered sphalerite exhibiting grading and draping features.


0
cm
5


0
cm
5

Plate 5.28c Photograph of drillcore illustrating slumped and disrupted internal sphalerite layers in 2-3 Lens. Note the graded bedding within the overlying sediment comprising detrital silt/mud and lesser sphalerite.

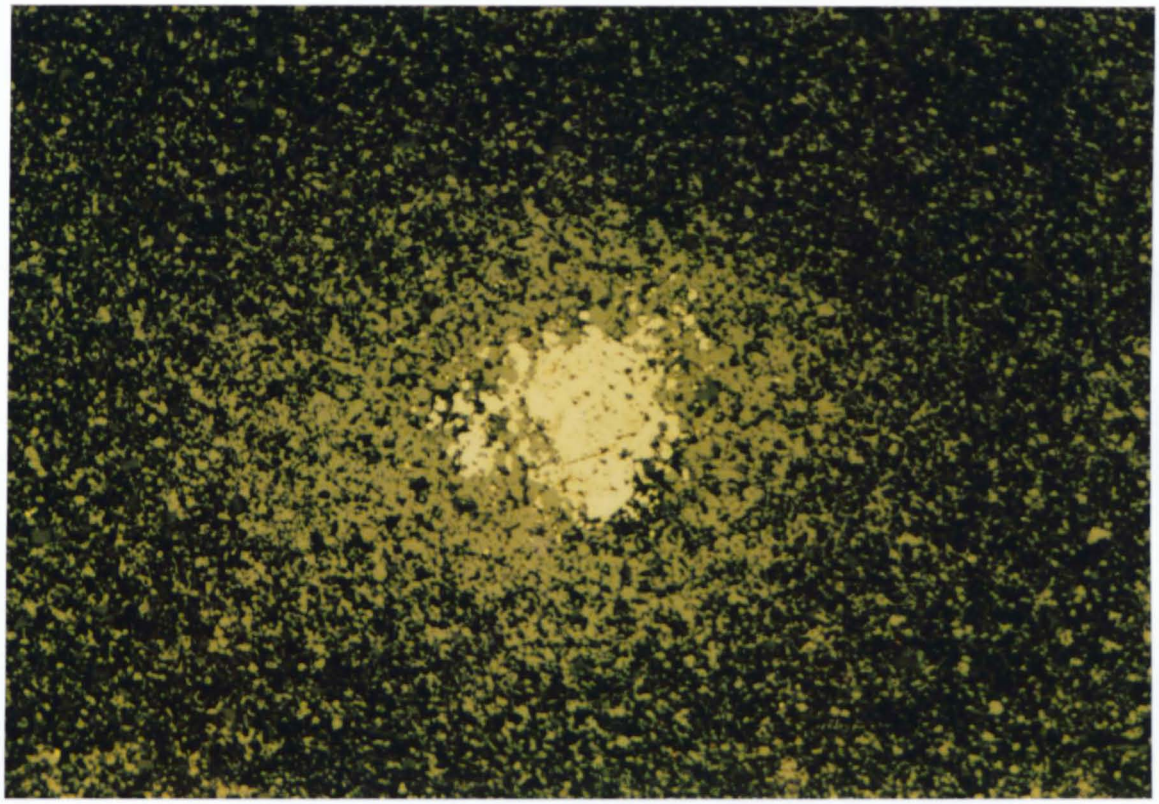
Plate 5.29 Transmitted light photograph illustrating detrital quartz-rich layers deformed and squeezed up into sphalerite layers (2-3 Lens, 252/253S).

Way up ←

2mm

Plate 5.30 Reflected light photograph illustrating individual porphyroblastic galena growths within a sphalerite-rich layer in 2-2 Lens (W20S).

Plate 5.31a Photograph from an underground heading in 2-1 Lens (229N) illustrating a complex assemblage of poorly sorted sulphide clasts. Lens cap for scale.

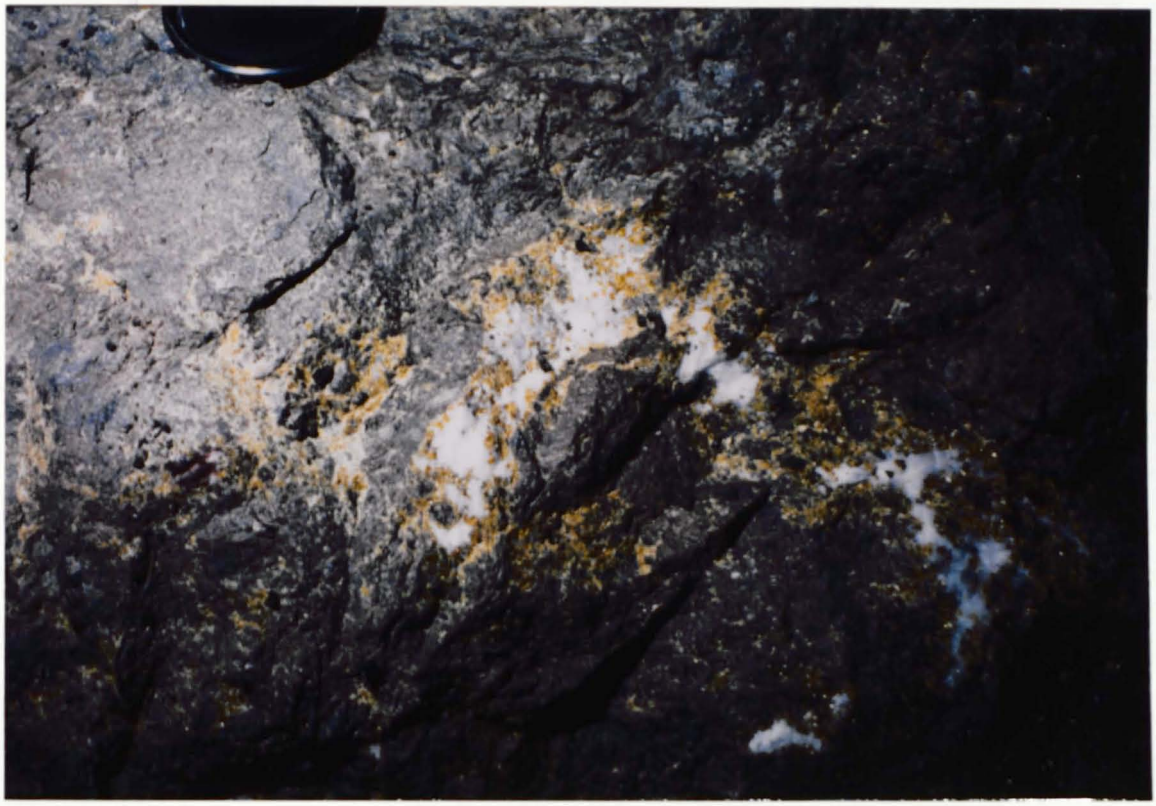


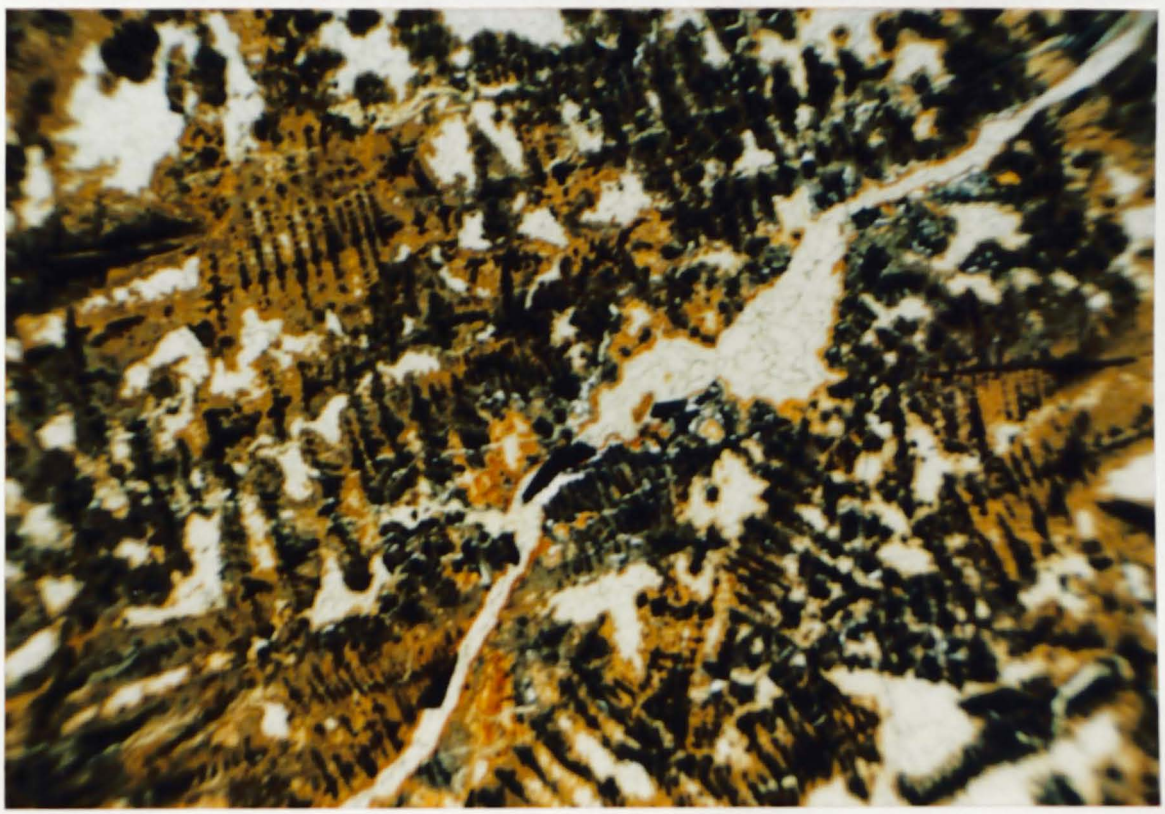
0.2mm

Plate 5.31b Photograph of drillcore illustrating complex sulphide clasts in 2-1 Lens.

Plate 5.32 Photograph from an underground heading in 1-5 Lens (Block 6, FW contour drifts) illustrating an in-situ sulphide growth assemblage with late-stage, yellow honeyblende sphalerite crystals and coarse white barite clearly evident. Lens cap for scale.

Plate 5.33a Transmitted light photograph illustrating dendritic galena growths (1-5 Lens, Block 7, panel 7).

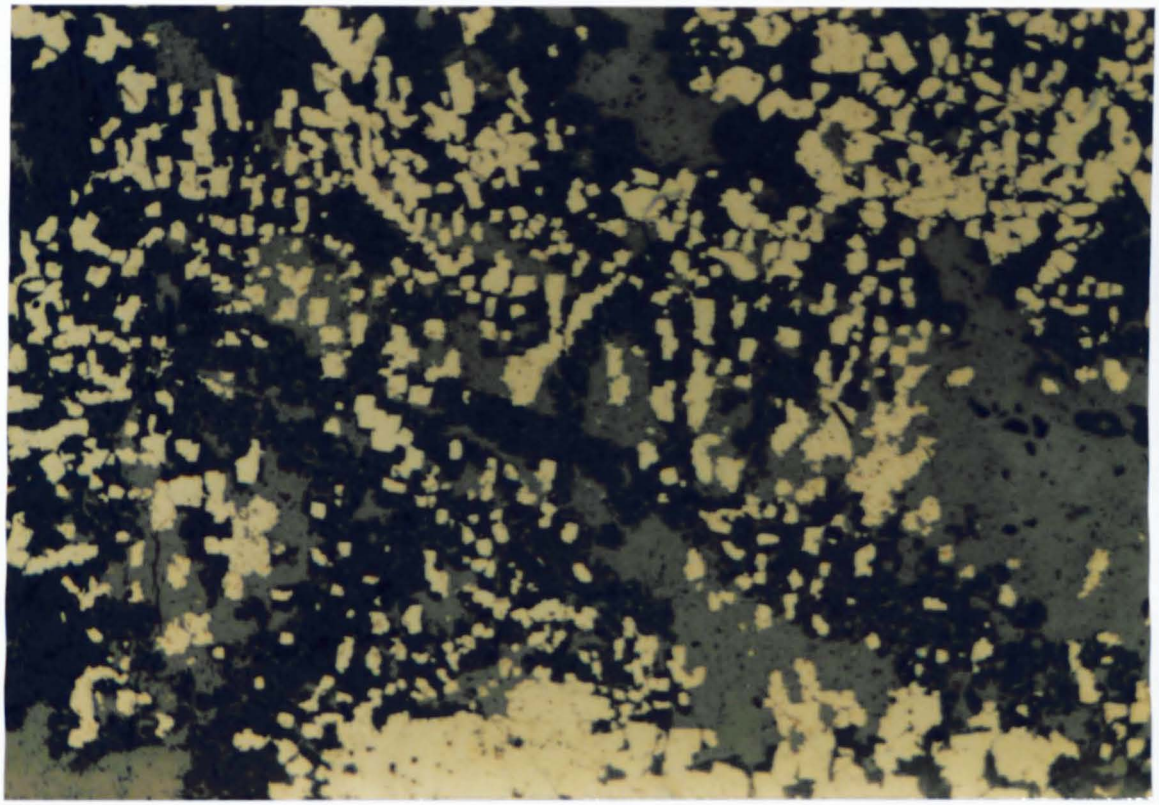




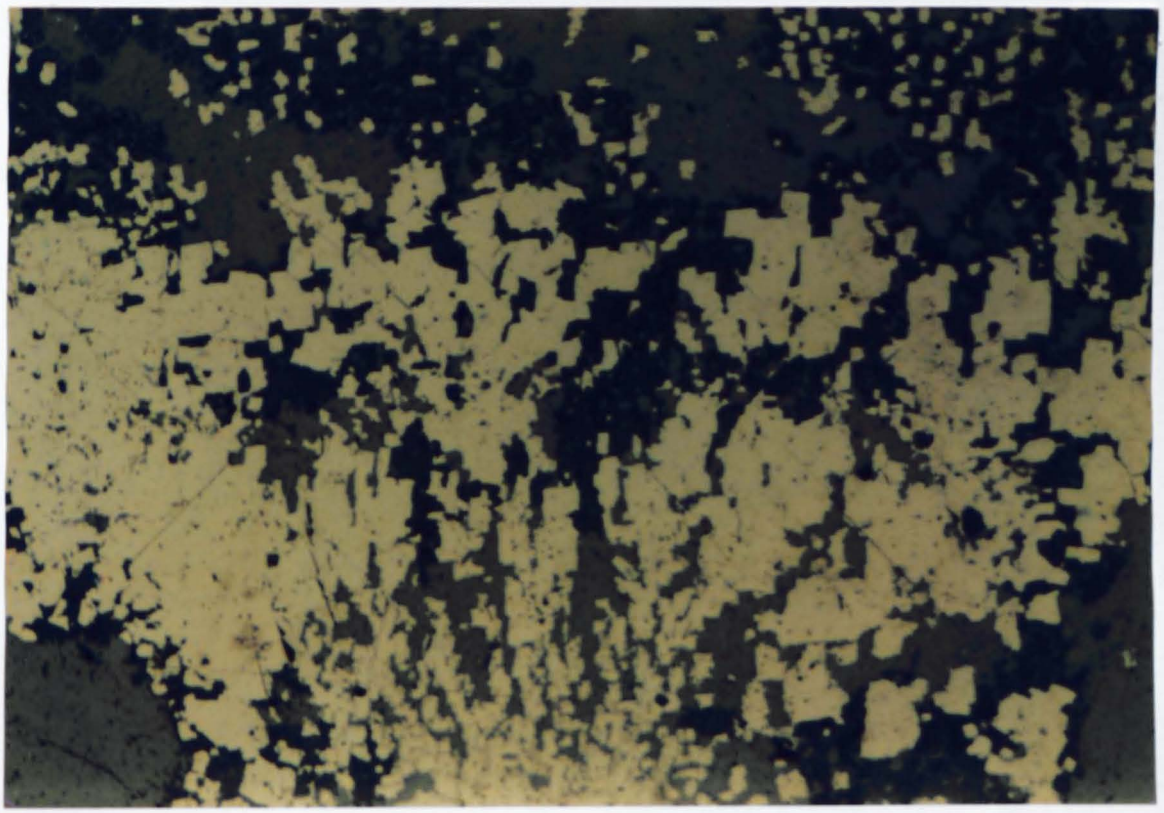
1mm

Plate 5.33b Reflected light photograph illustrating skeletal galena crystals (2-4 Lens, 252/253S).

Plate 5.33c Reflected light photograph illustrating skeletal galena crystals which are transitional into cubic galena growths (2-4 Lens, 252/253S).



0.5mm



0.5mm

Plate 5.34a Photograph of a handspecimen from 1-5 Lens (1270 RAW) illustrating "stalactitic" pyrite growths and laminated sulphide sediment beneath, precipitated within a bedding-parallel open space. Specimen is approximately 20cm across.

Plate 5.34b Photograph from an underground heading in 2-3 Lens (252/253S) illustrating "stalactitic" growths with laminated sulphide sediment below.

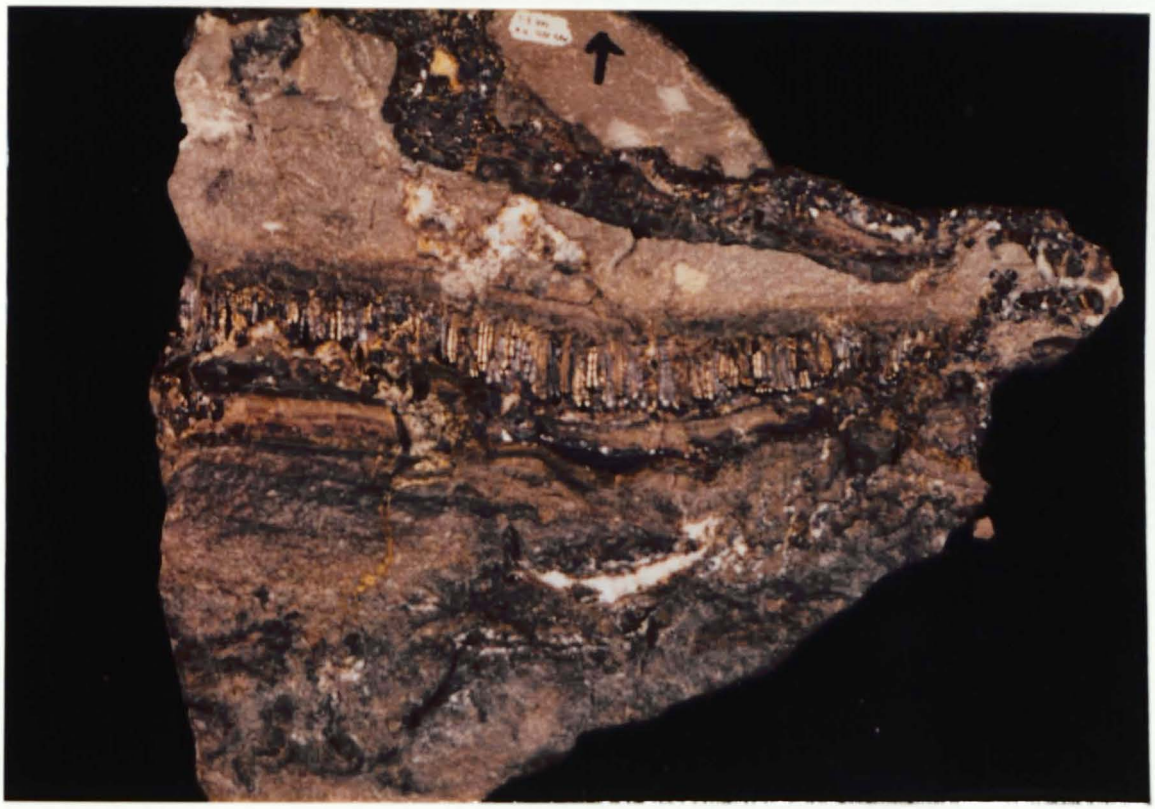
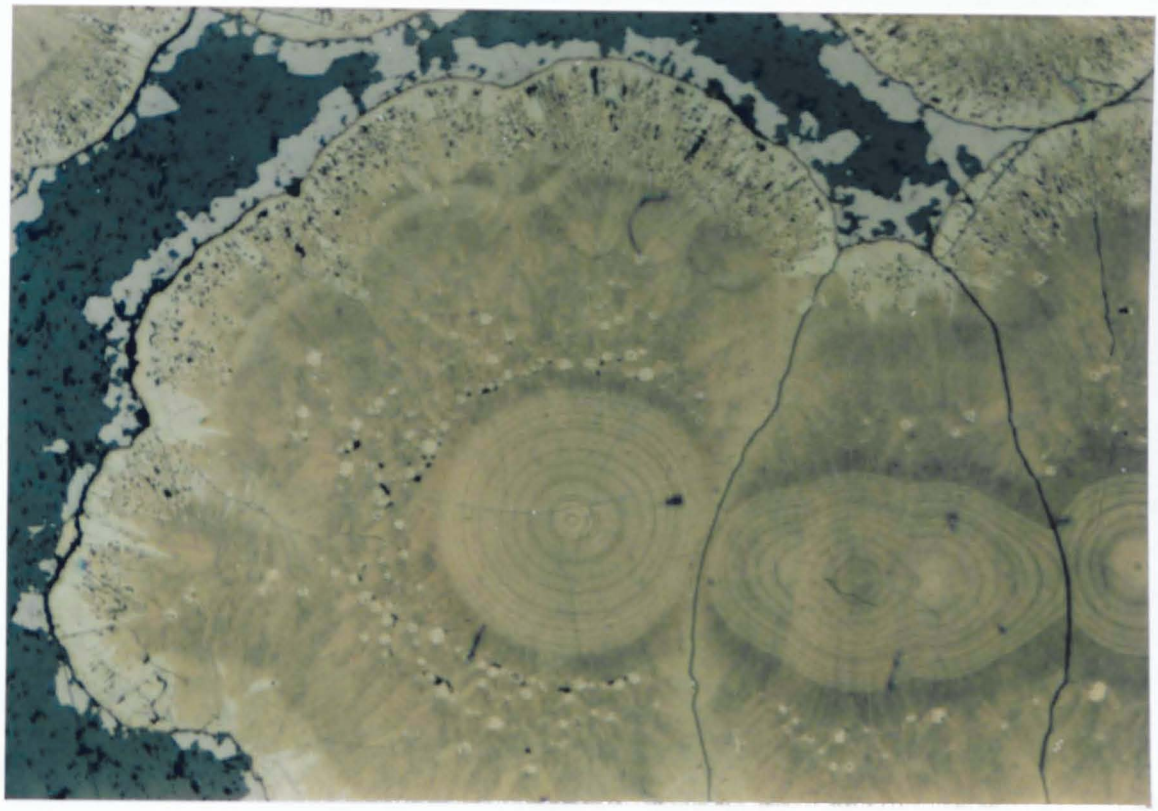
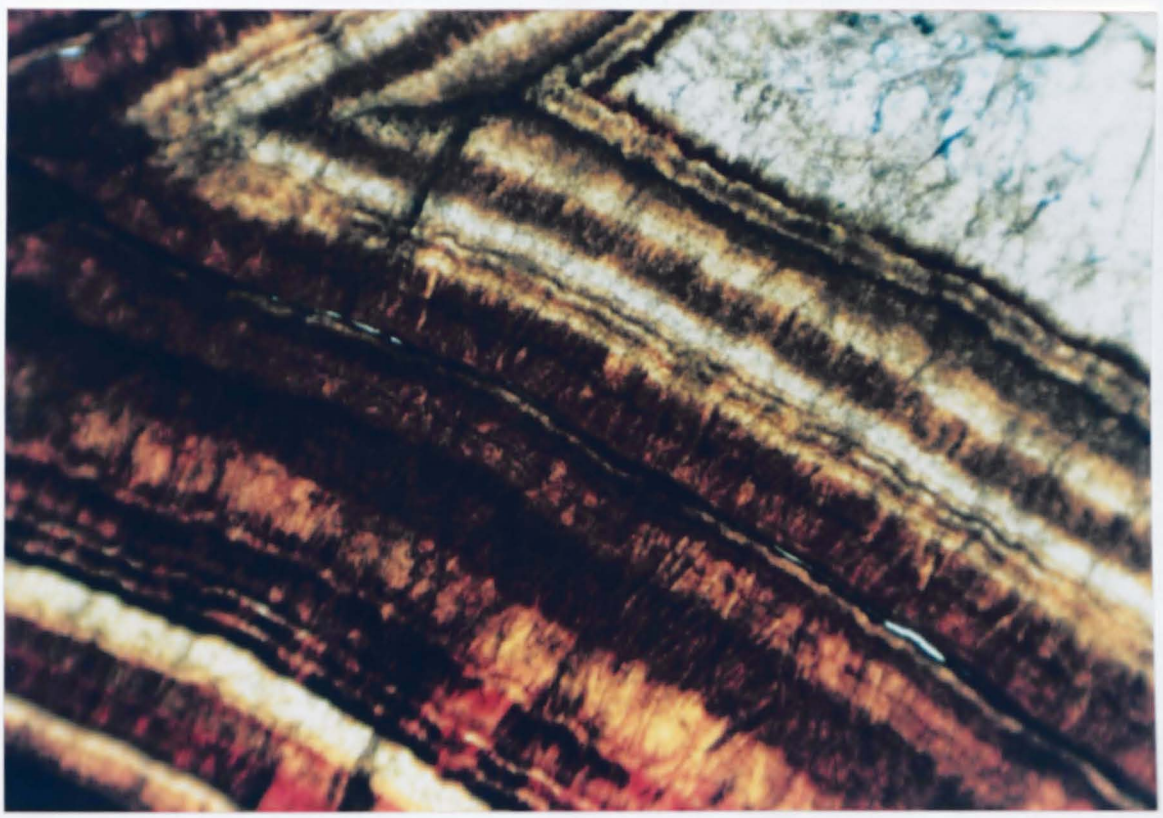


Plate 5.35 Reflected light photograph showing pyrite "stalactites" illustrated in Plate 5.34a showing a concentrically banded core and radiating overgrowths within the pyrite, with later overgrowths of sphalerite and galena.

Plate 5.36a Transmitted light photograph illustrating fine, rhythmically banded sphalerite in 1-5 Lens.



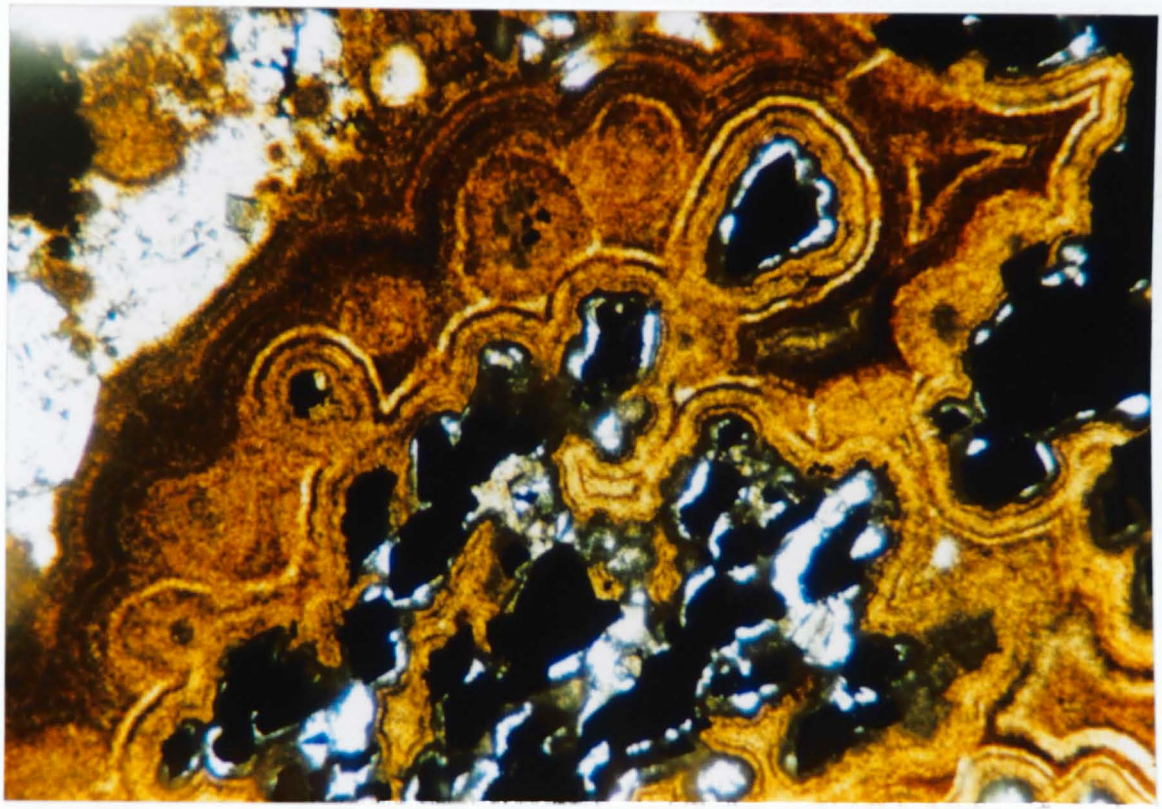
0.5mm



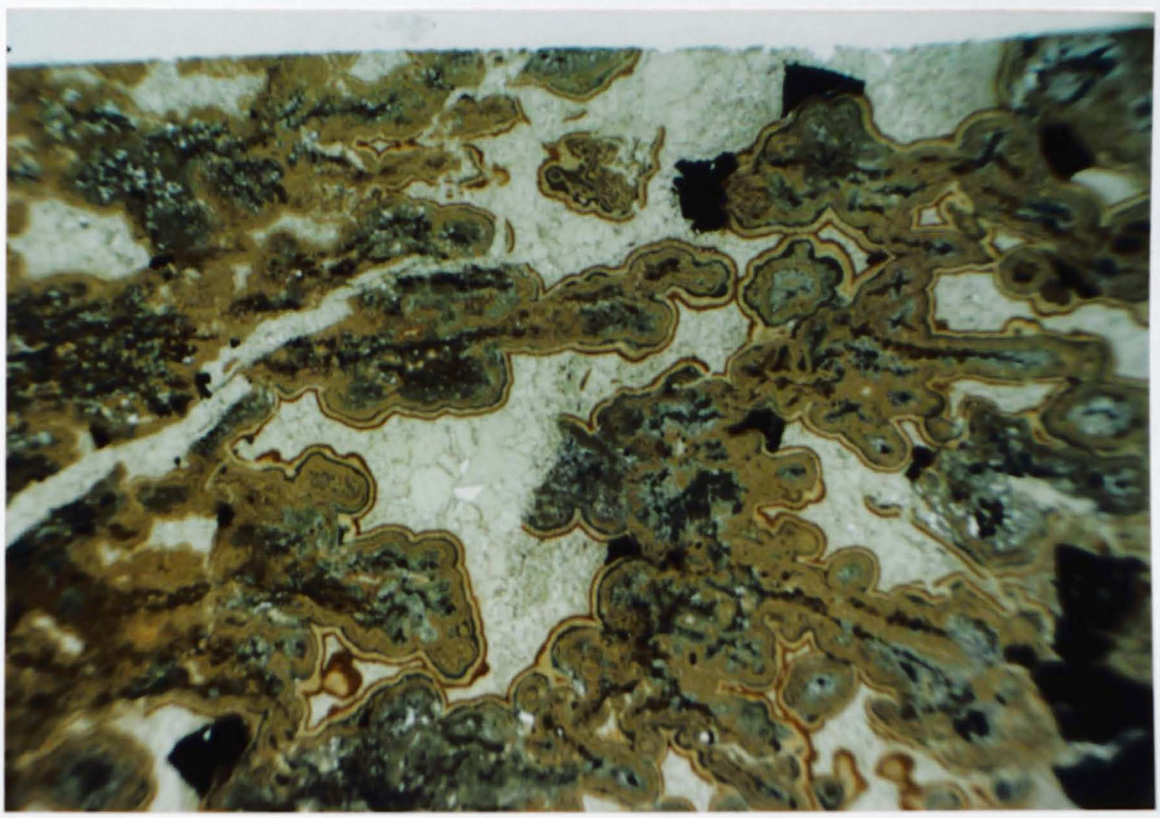
0.1mm

Plate 5.36b Transmitted light photograph illustrating fine rhythmically banded or colloform sphalerite overgrowths on skeletal galena crystals in 2-3 Lens (252/253S).

Plate 5.36c Transmitted light photograph illustrating a series of interconnected colloform sphalerite overgrowths nucleating on earlier dendritic galena growths, with clear late-stage honeyblende sphalerite (2-4 Lens, 252/252S).



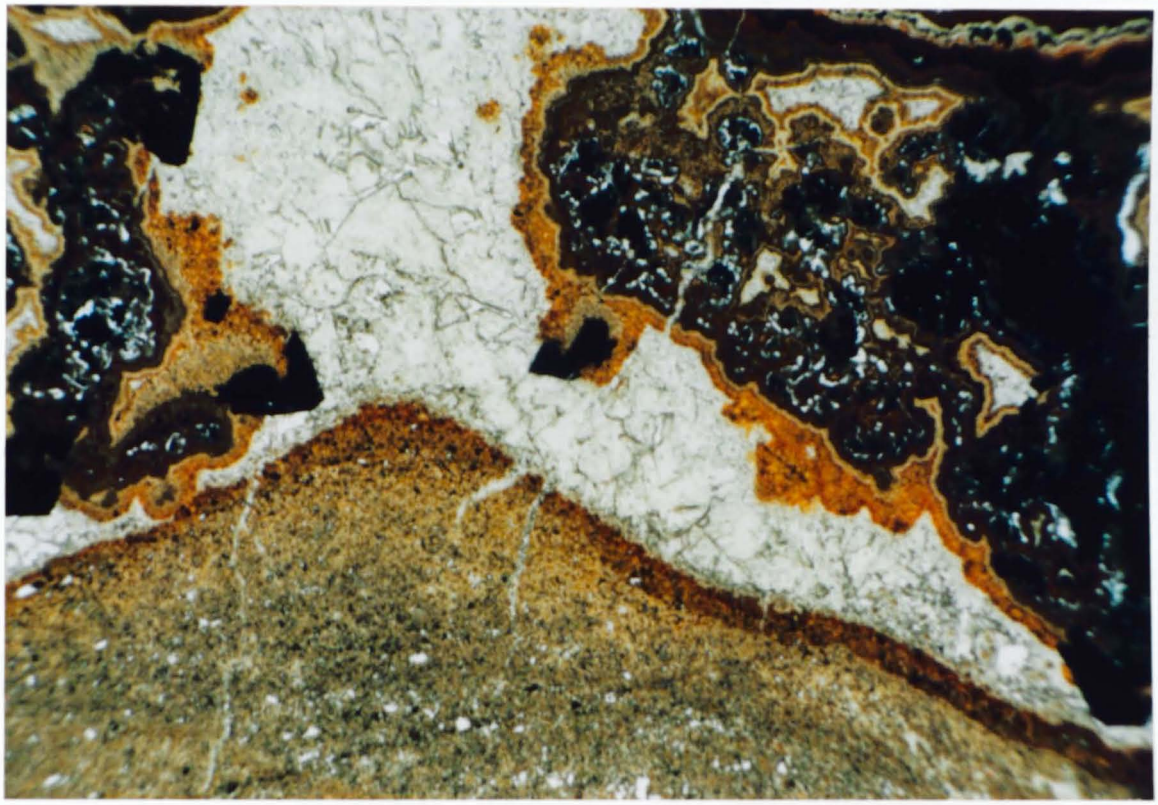
0.5mm



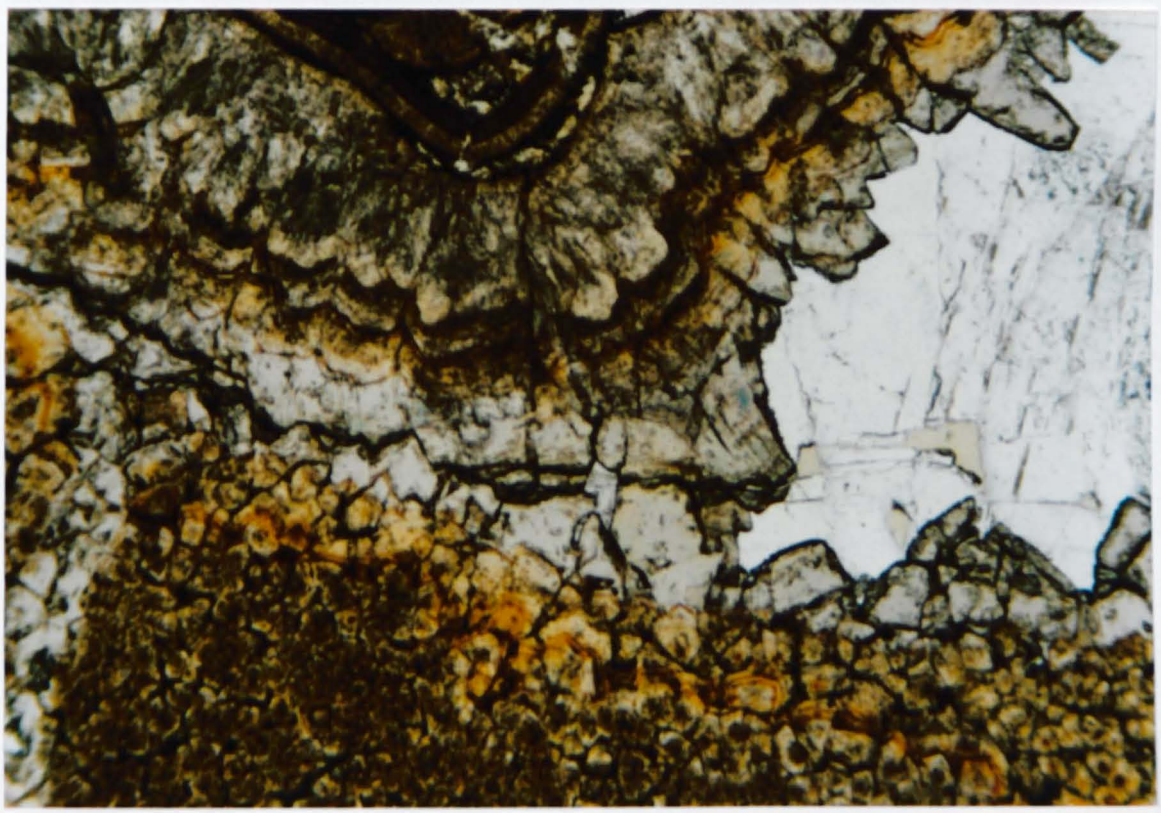
3mm

Plate 5.37a Transmitted light photograph illustrating geopetal sphalerite sediments which can be traced into rhythmically banded overgrowths above (2-3 Lens, 252/253S).

Plate 5.37b Transmitted light photograph illustrating zoned crystals within a geopetal sphalerite sediment which exhibits the same zoning as a coeval rhythmic crust (2-4 Lens, 252/253S).



1mm

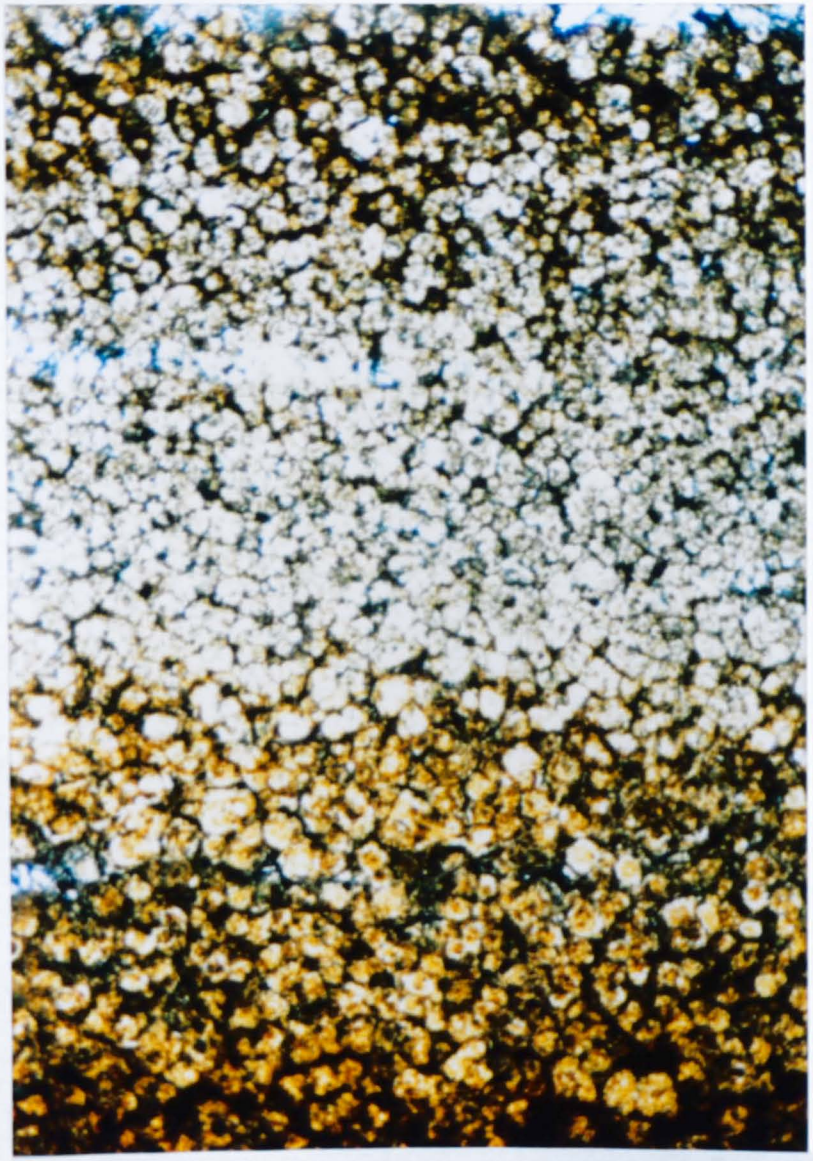


0.5mm

Plate 5.38a Transmitted light photograph illustrating geopetal sphalerite sediment comprising microcrystalline sphalerite layers (2-2 Lens, W20S). Note the detrital quartz layers and also the tension fractures within the sphalerite with cloudy carbonate alteration haloes associated.

Plate 5.38b Transmitted light photograph illustrating geopetal sphalerite sediment comprising granular-zoned sphalerite crystals (2-3 Lens, 252/253S).

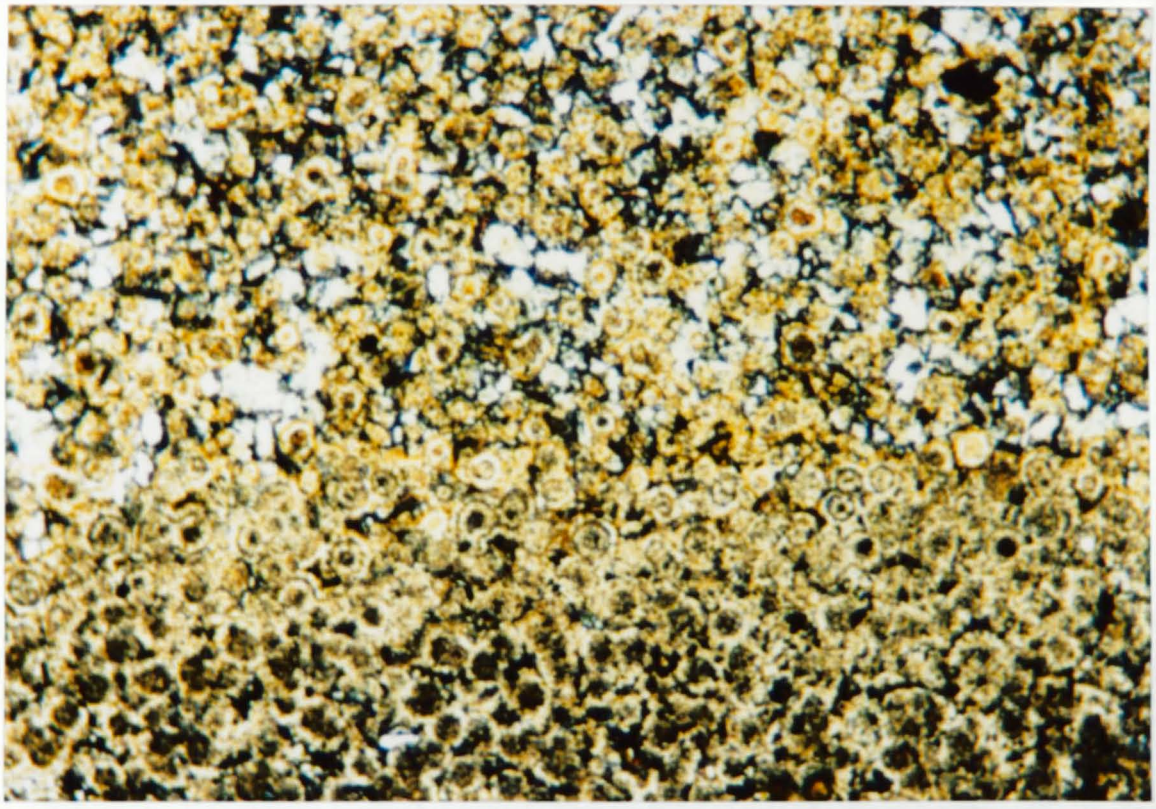
View this way



0.2mm

4mm

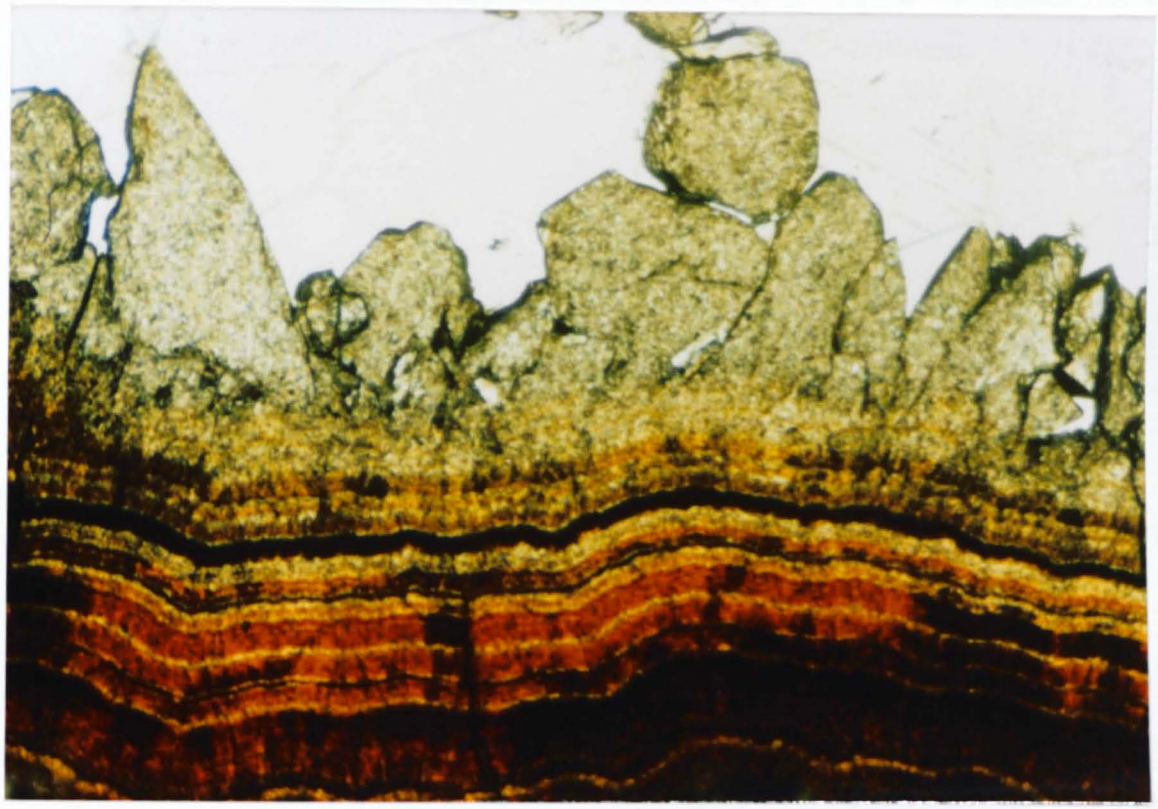
Plate 5.38c Transmitted light photograph illustrating geopetal sphalerite sediment comprising spherical sphalerite growths (2-1 Lens, 229N).



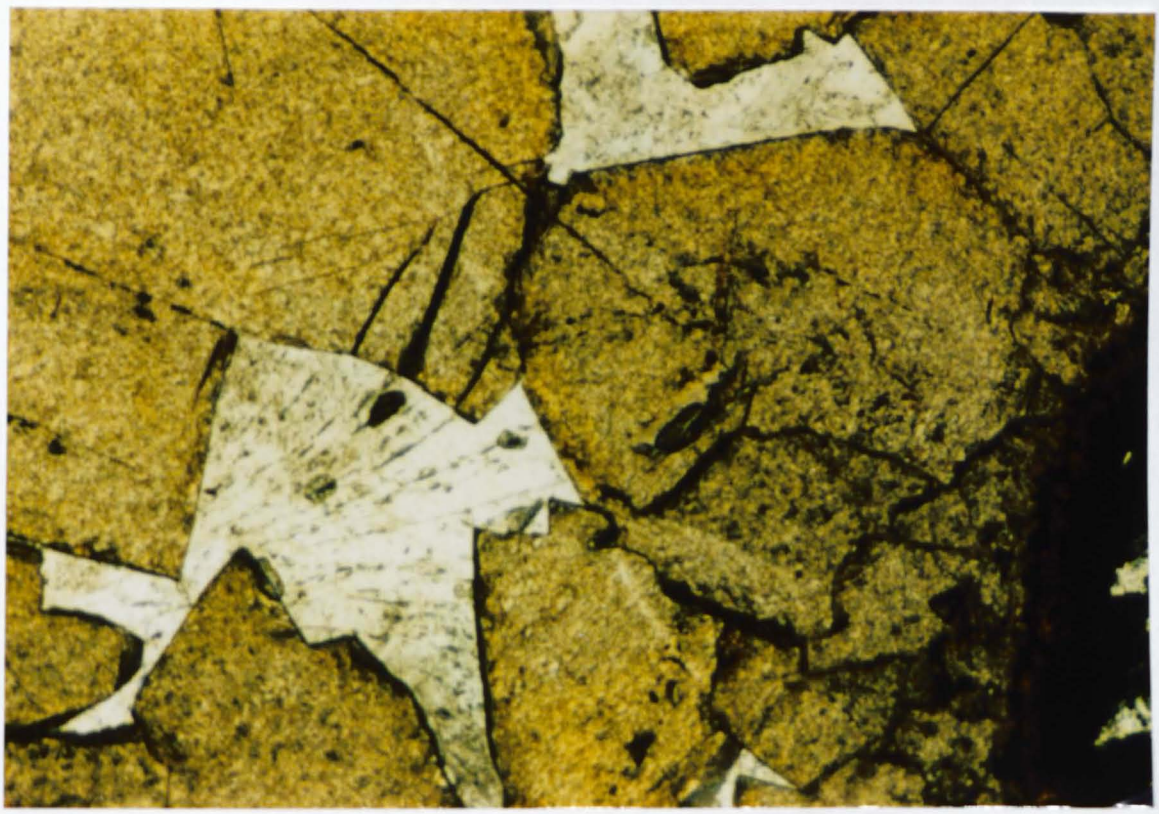
0.2mm

Plate 5.39a Transmitted light photograph illustrating rhythmically banded sphalerite transitional into late honeyblende sphalerite (2-3 Lens).

Plate 5.39b Transmitted light photograph illustrating coarse honeyblende sphalerite (2-4 Lens, 252/253S).



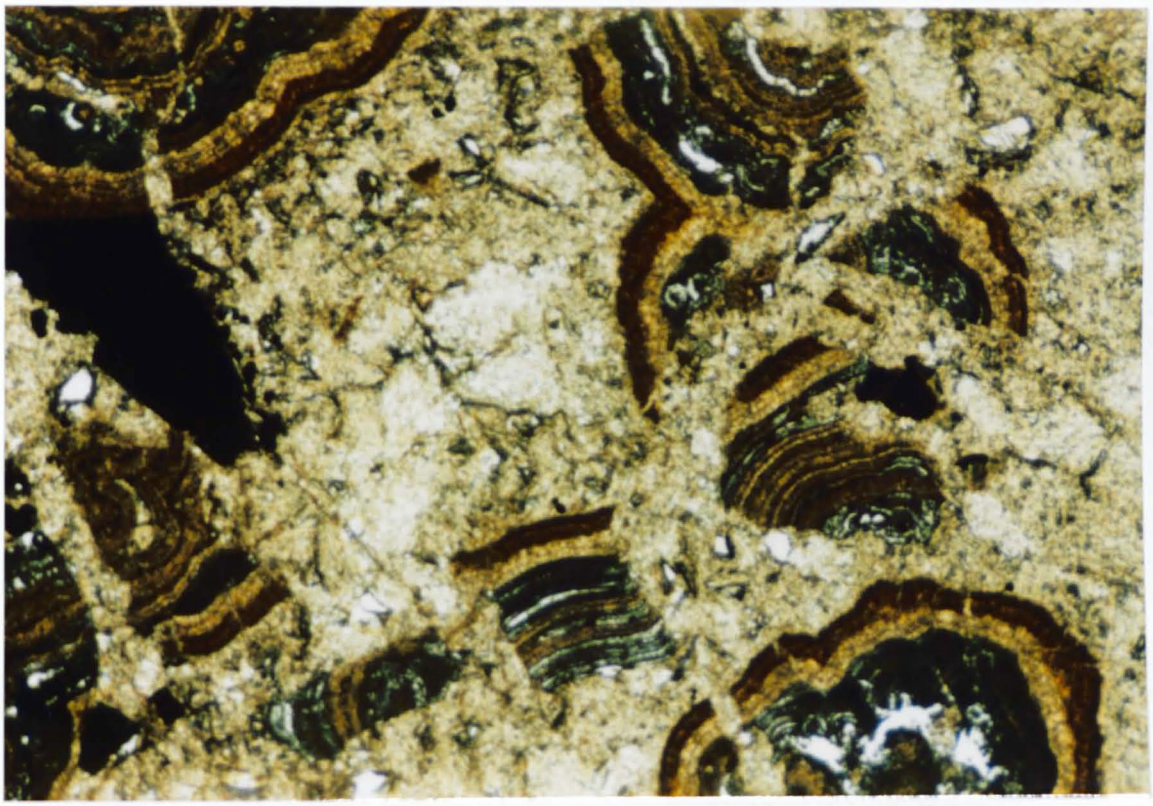
0.5mm



0.2mm

Plate 5.40 Transmitted light photograph illustrating coarse honeyblende infilling brecciated layers of rhythmically banded sphalerite (2-3 Lens, 252/253S).

Plate 5.41 Transmitted light photograph (crossed-polars) illustrating late-stage laths of barite (1-5 Lens).

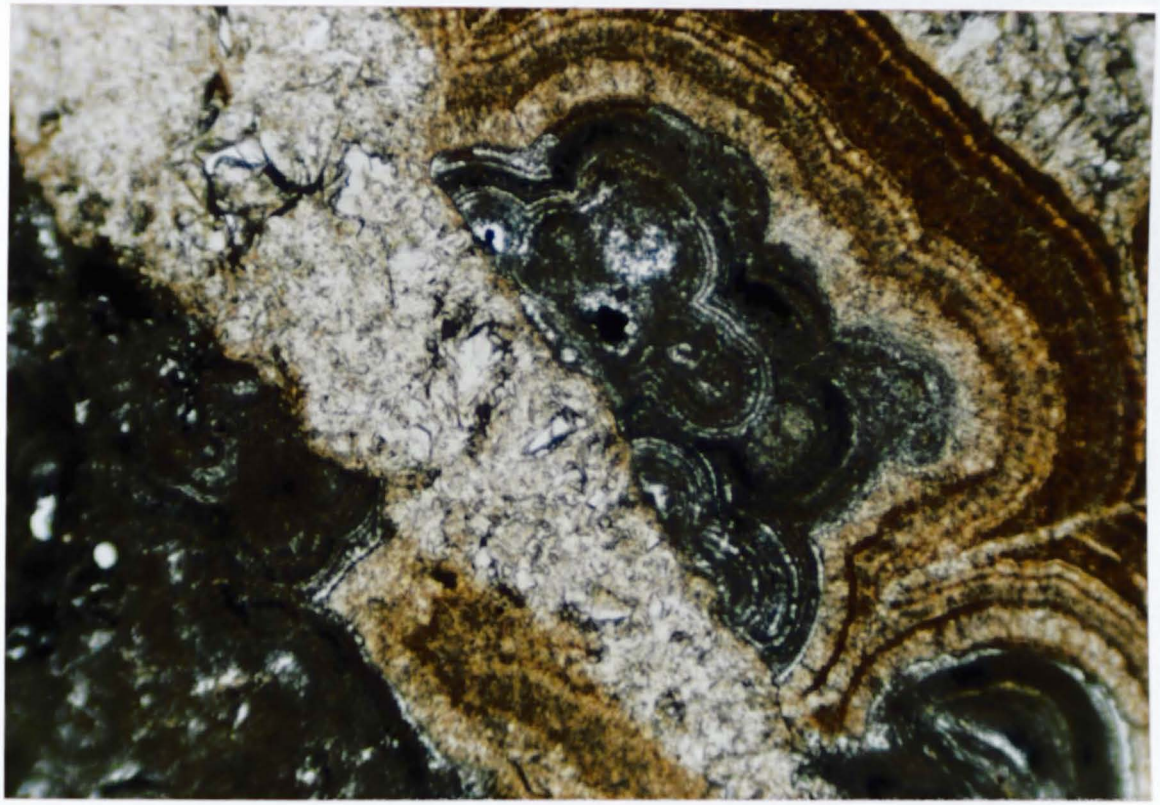


0.5mm

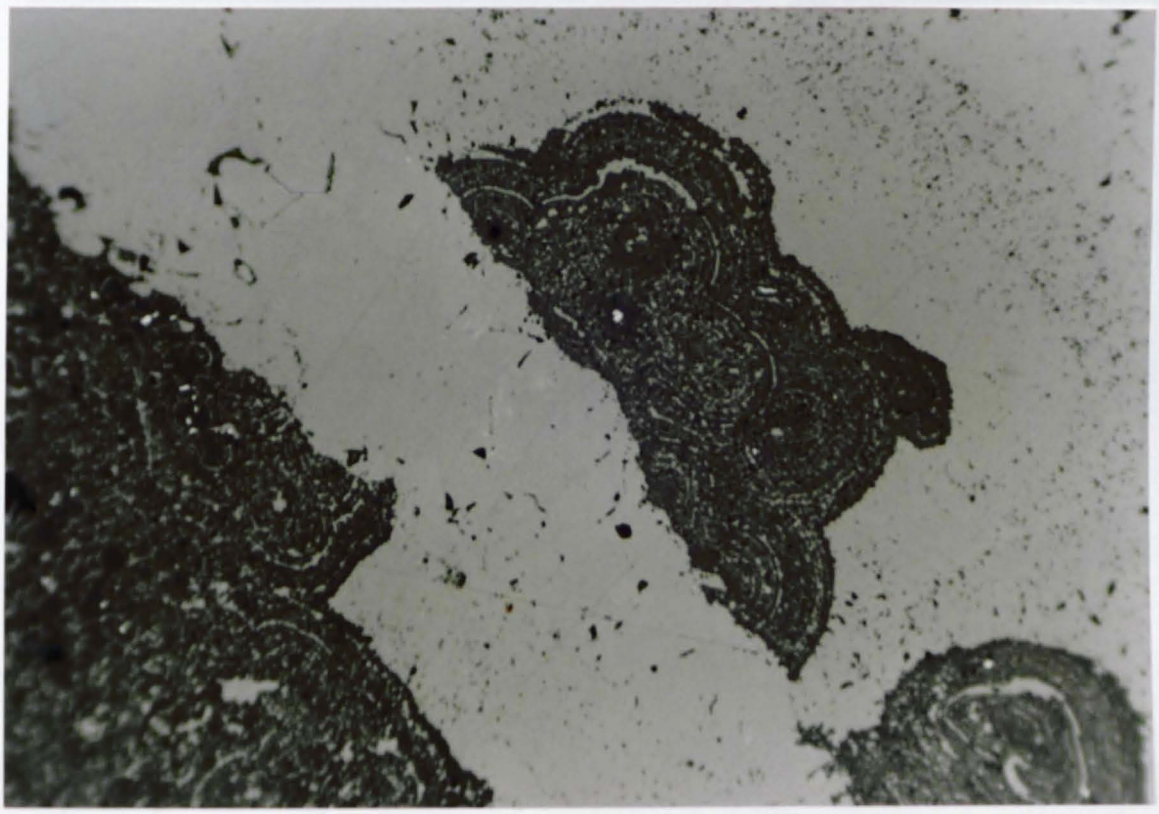
0.5mm

Plate 5.42a Transmitted light photograph illustrating a "cloudy" appearance to parts of the rhythmically banded sphalerite due to replacement by late-stage calcite. Note that the last stage of mineralization is coarse honeyblende sphalerite which cuts both the rhythmically banded sphalerite and replacing calcite (1-5 Lens, Block 6 FW contour drifts).

Plate 5.42b Reflected light photograph of the same view as Plate 5.42a showing numerous minute sphalerite inclusion trails within the calcite overgrowths.



0.2mm



0.2mm

Plate 5.43 Photograph of drillcore illustrating sulphide at the contact between micrite and an overlying dolomite in 1-5 Lens. The margins of the dolomite are replaced by pale sphalerite.

Plate 5.44 Photograph of drillcore illustrating brecciated micrite above sulphides in 1-5 Lens.

View this way

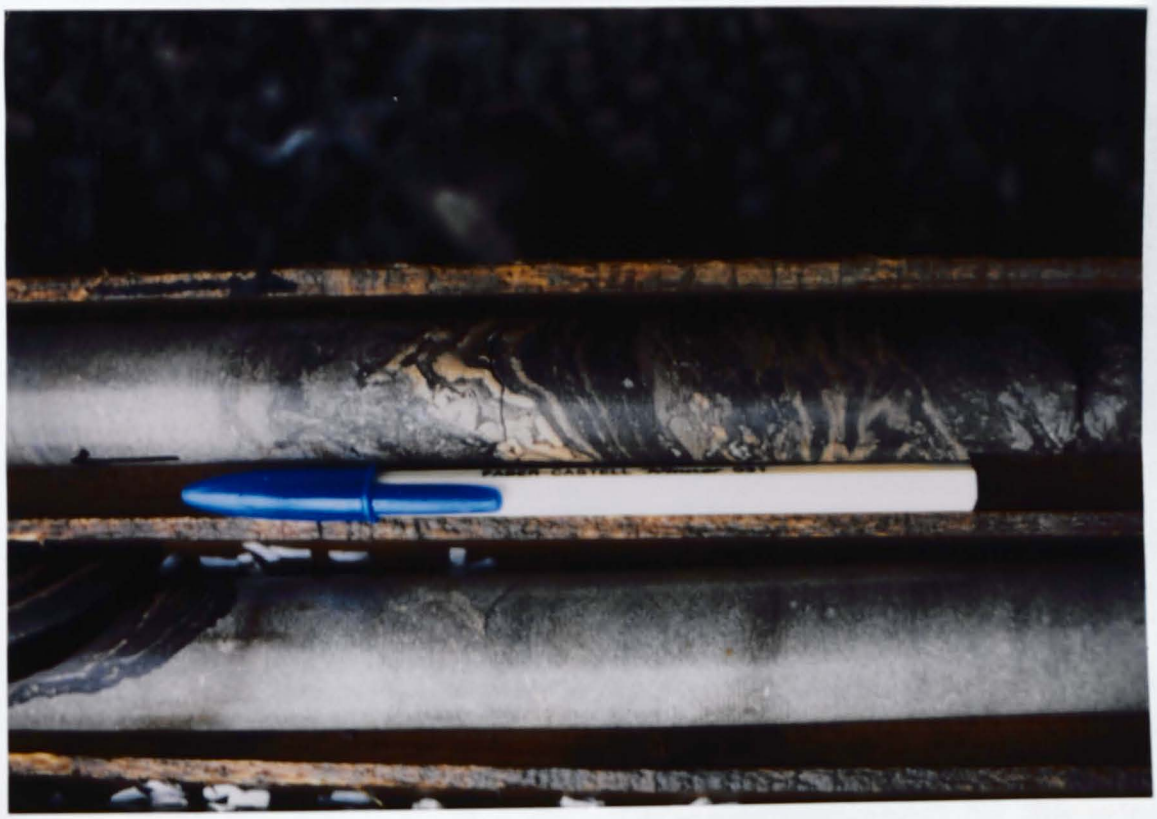


Plate 5.45 Photograph from an underground heading in 1-5 Lens (Block 14) illustrating chaotic, massive sulphides at the contact between micrite and overlying pale dolomite. Note the stylolites in the micrites are truncated by the sulphides. Hammer for scale.

Plate 5.46 Photograph of a handspecimen from 1-5 Lens (183N) illustrating complex, chaotic clasts of sulphide.


0
5
cm

Plate 5.47 Photograph of a handspecimen from 1-5 Lens (Block 7, panel 7) illustrating chaotic clasts of sulphide and host micrite.

Plate 5.48 Reflected light photograph illustrating late-stage pyrite within galena and sphalerite 1-5 Lens. The galena is fractured and brecciated.


cm
5

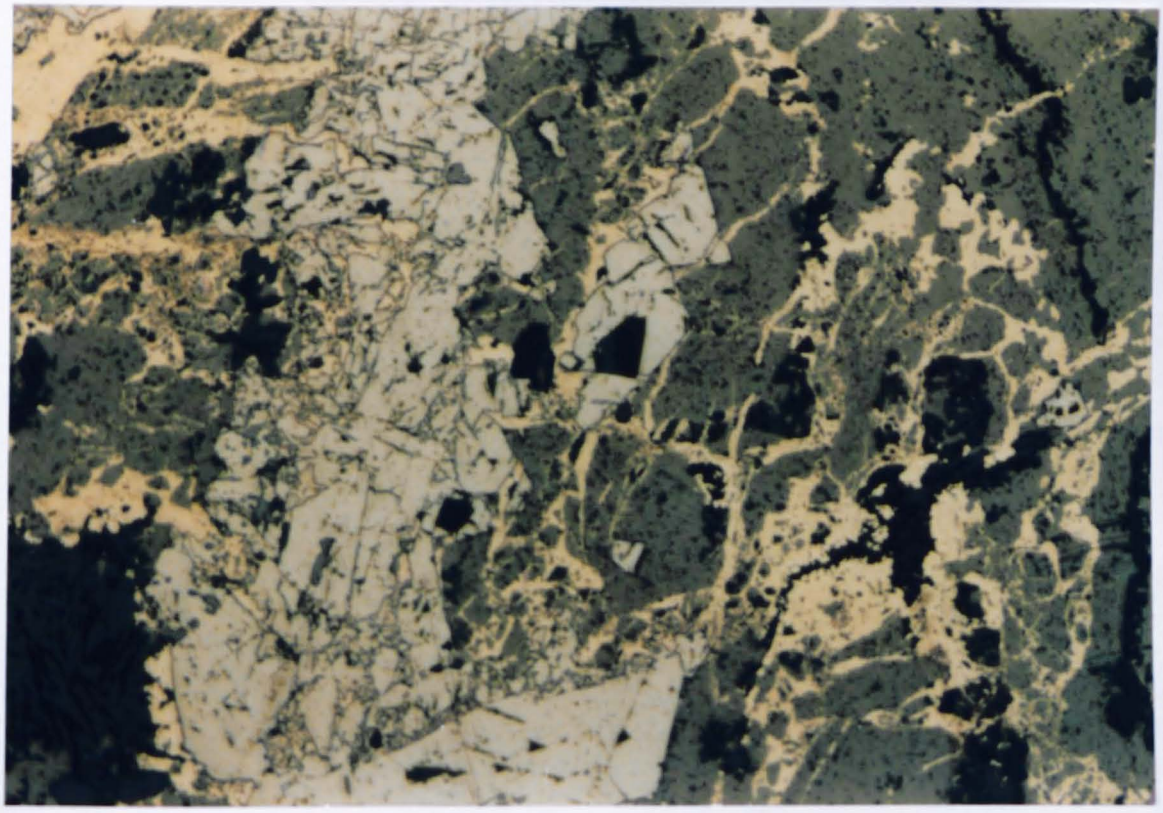
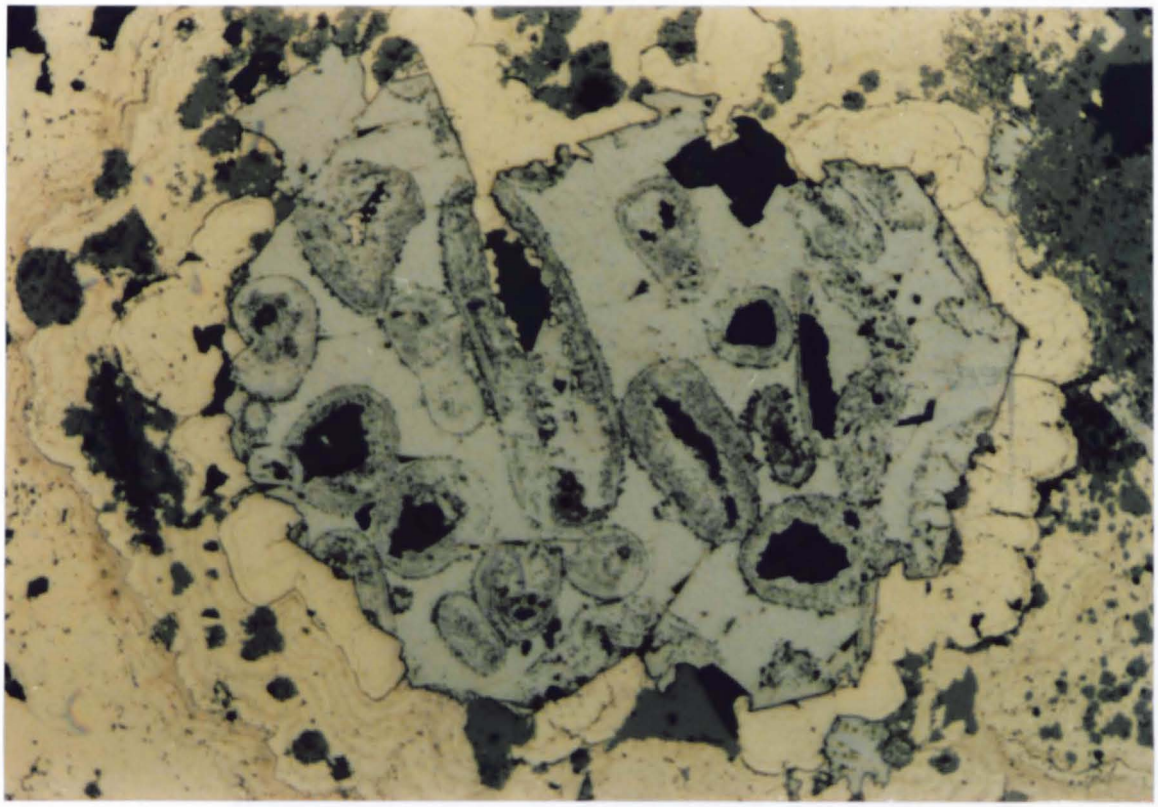

0.5mm

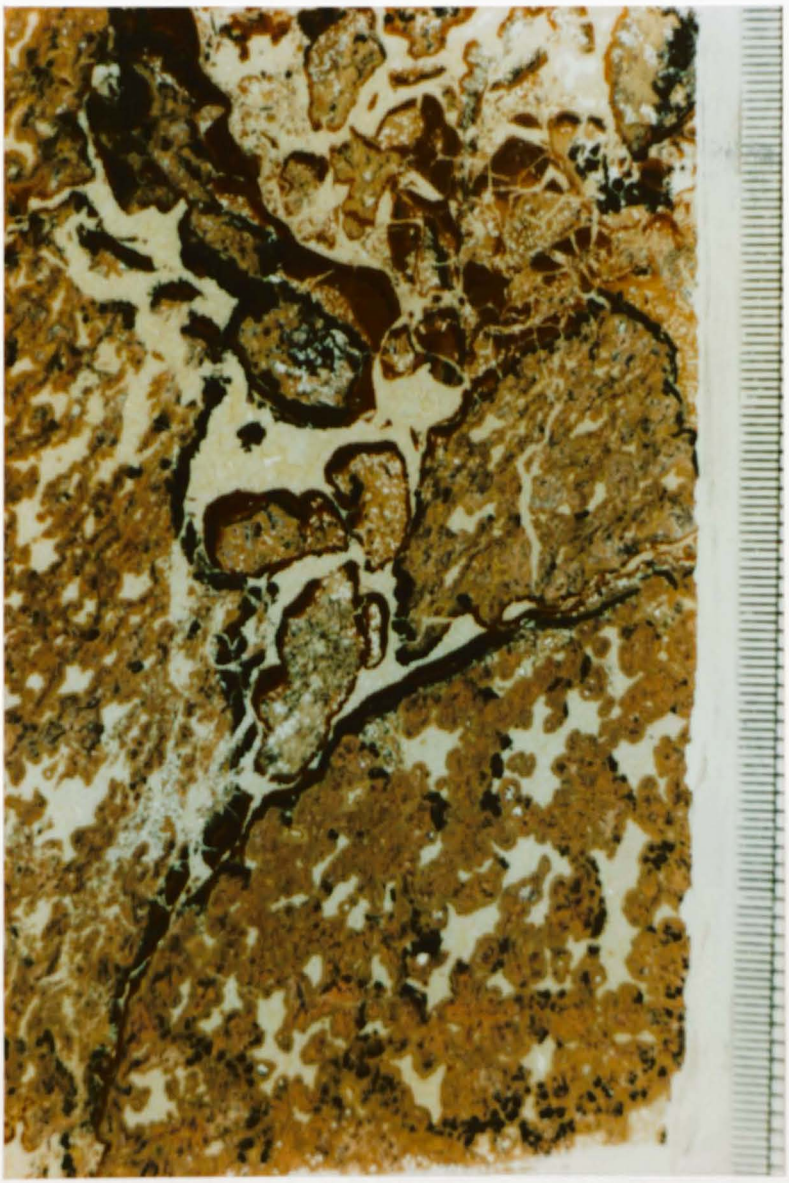
Plate 5.49 Reflected light photograph illustrating the centre of a small concretionary sulphide growth, consisting of galena replacement of carbonate allochems. Note the generally open-packed nature of the allochems, with remnant fringing cements still evident.

Plate 5.50 Photograph of drillcore from 1-5 Lens illustrating sphalerite deposited on the margins of fractures and subsequently disrupted.



0.5mm

Plate 5.51 Transmitted light photograph illustrating disrupted clasts of in-situ sulphide growths, with later sphalerite and pyrite geopetals on the upper surfaces of the clasts (1-5 Lens, 133W). The geopetals are also locally disrupted. Scale on the ruler is 1/2mm.

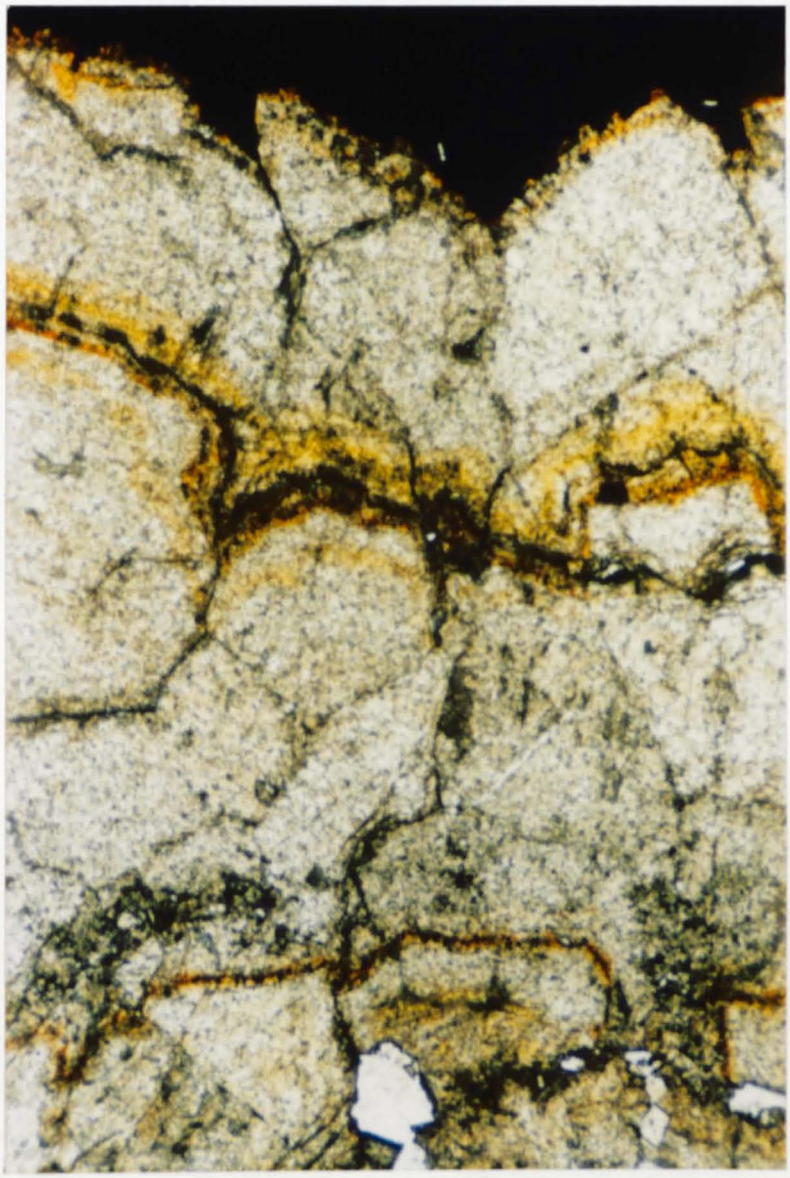


1cm

Plate 5.52 Photograph from an underground heading in 2-5 Lens west (1190 haulage) illustrating a green shale band which acted as a local barrier to sulphides deposited from the ascending ore fluids. Hammer for scale.

Plate 5.53 Photograph from an underground heading in 2-5 Lens (242S) illustrating high-grade massive sulphides with fracturing and brecciation of the host rock at the margins of the massive sulphides.

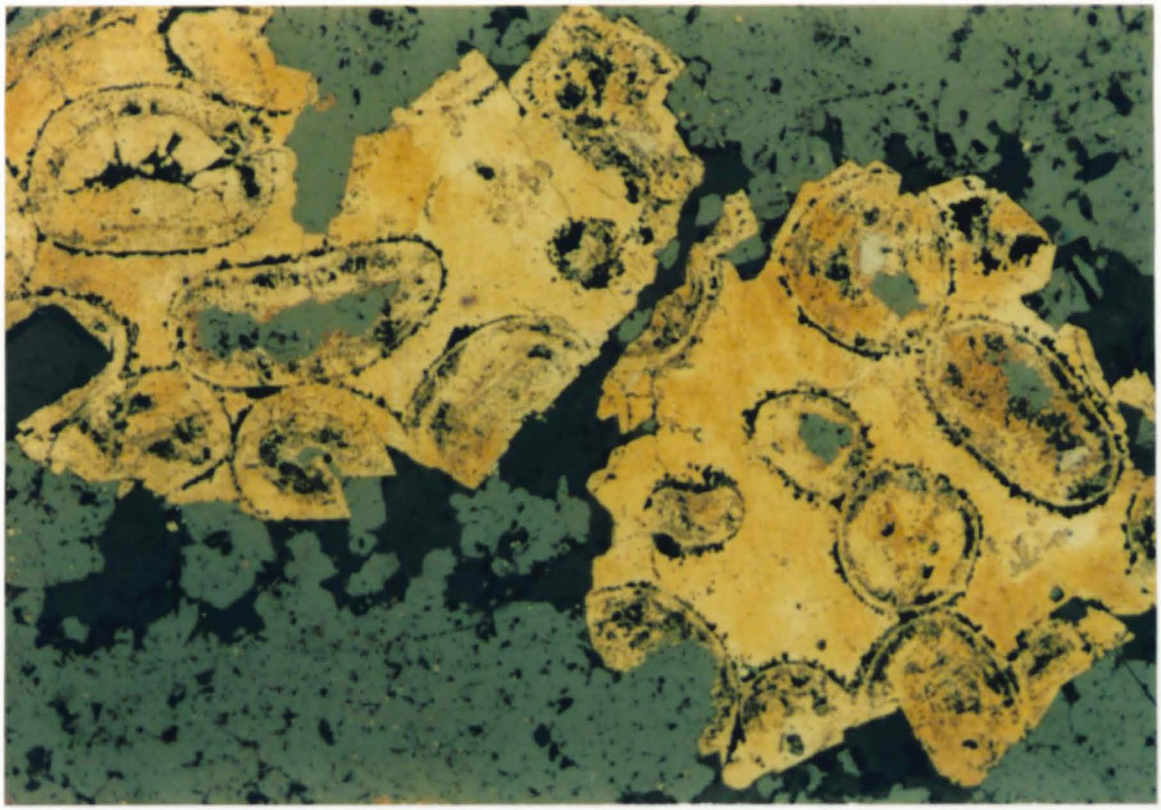
Plate 5.54 Transmitted light photograph illustrating coarse, poorly zoned sphalerite in 2-5 Lens (242S). The black material is galena.



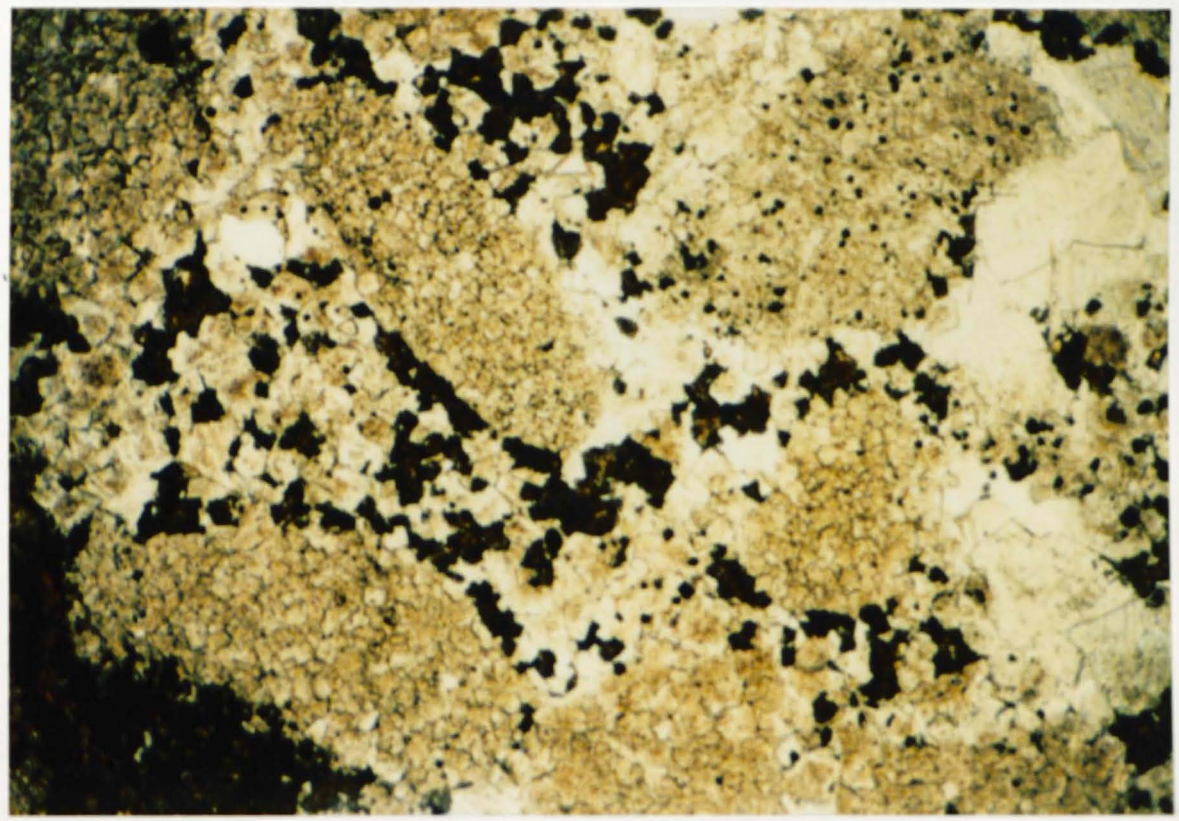
0.5mm

Plate 5.55 Reflected light photograph illustrating pyrite replacing oolites and pellets in 2-5 Lens (242S). Note the open packing within the replaced allochems.

Plate 5.56 Transmitted light photograph illustrating (brown) sphalerite preferentially developed in the matrix around pellets within the dolomitized host rock (2-5 Lens, 242S).

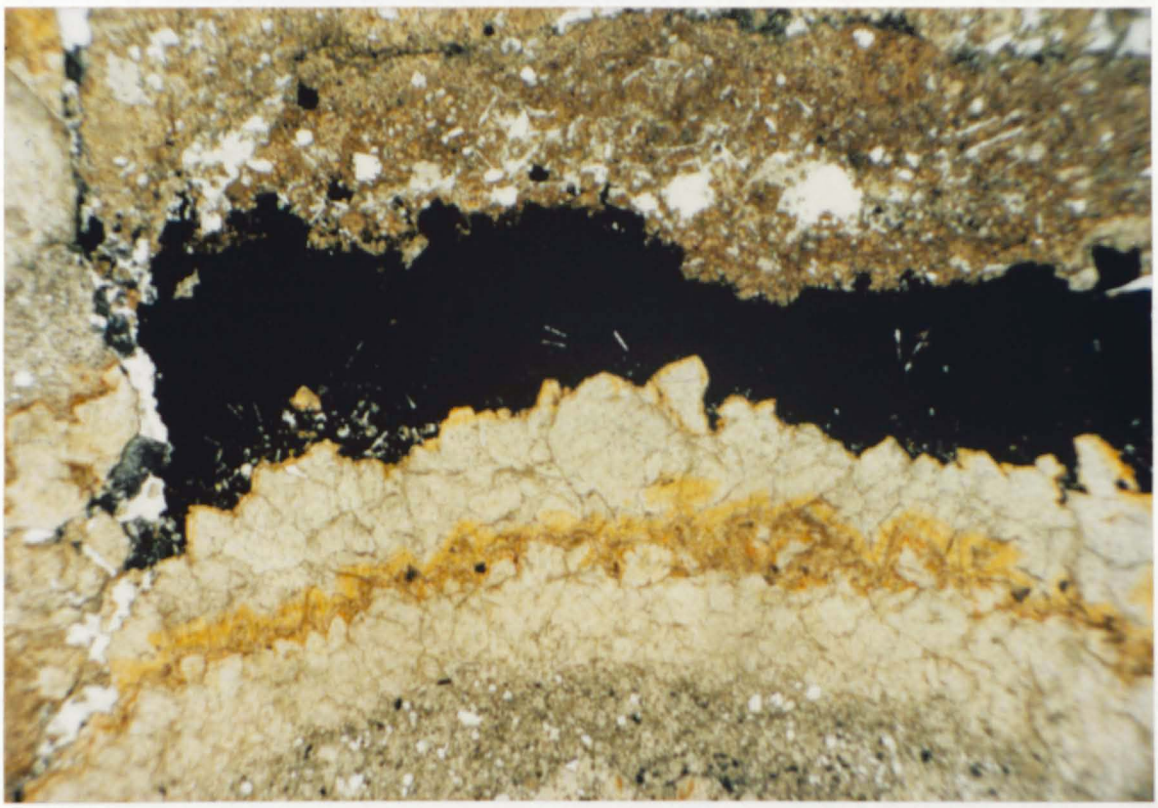


0.5mm



1mm

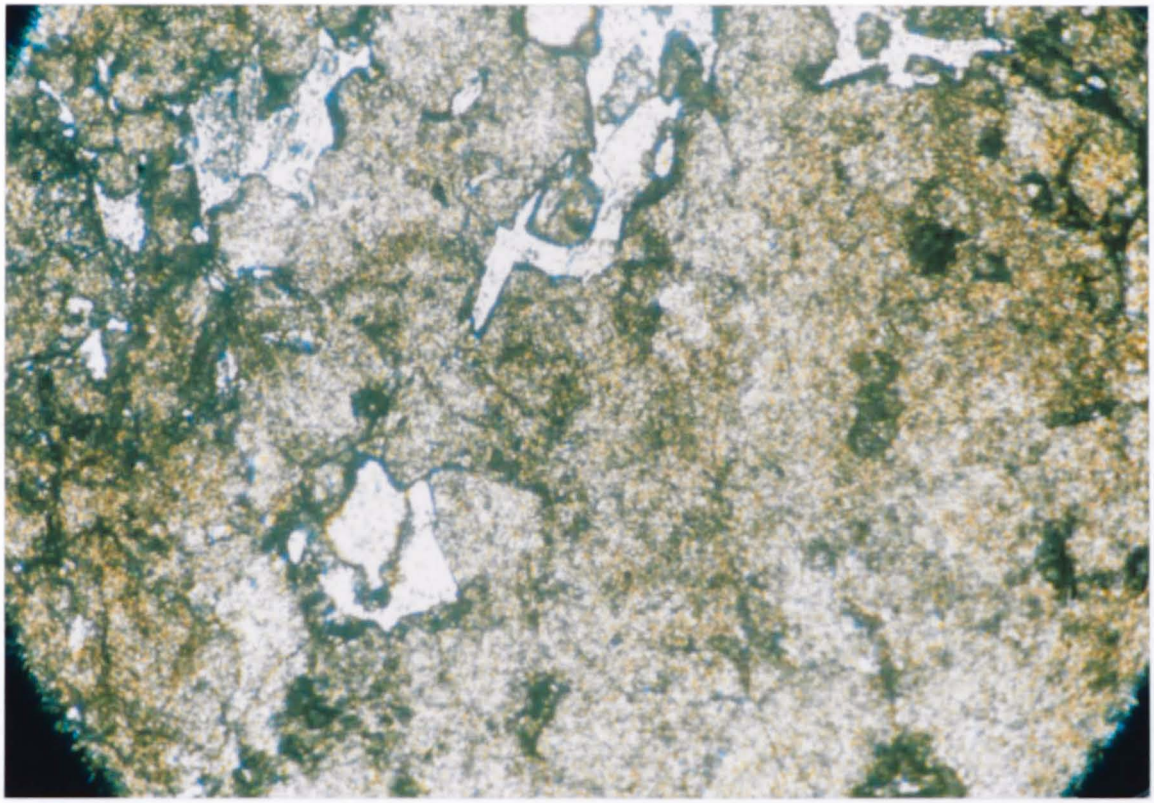
Plate 5.57 Transmitted light photograph illustrating bladed galena layers (black) deposited on top of the poorly zoned sphalerite in 2-5 Lens (242S).



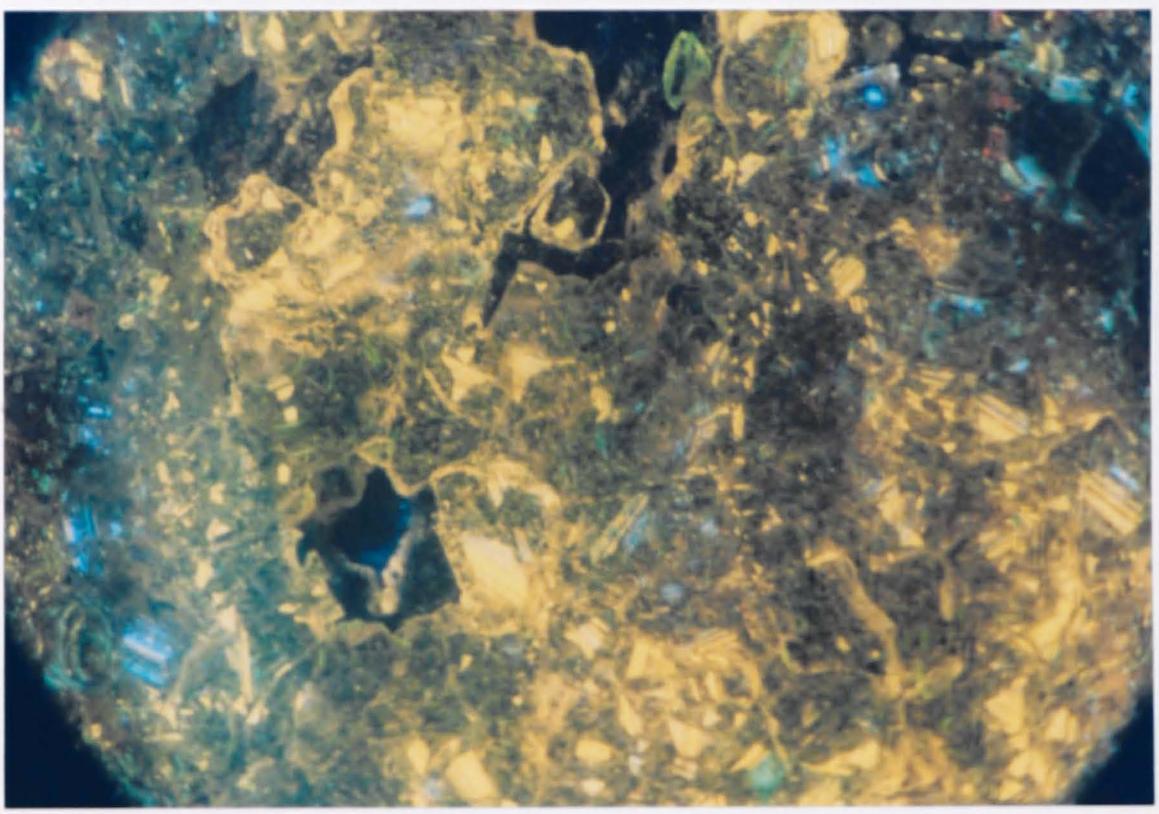
4mm

Plate 5.58a Transmitted light photograph illustrating massive, apparently featureless sphalerite, with no real zoning evident (2-5 Lens, 242S).

Plate 5.58b Cathodoluminescent light photograph of the same field of view as Plate 5.58a revealing zoning within sphalerite crystals and complex brecciation of the zoned crystals. It is clear that the sulphide deposition was associated with complex brecciation of the sulphides in a dynamic mineralizing environment.



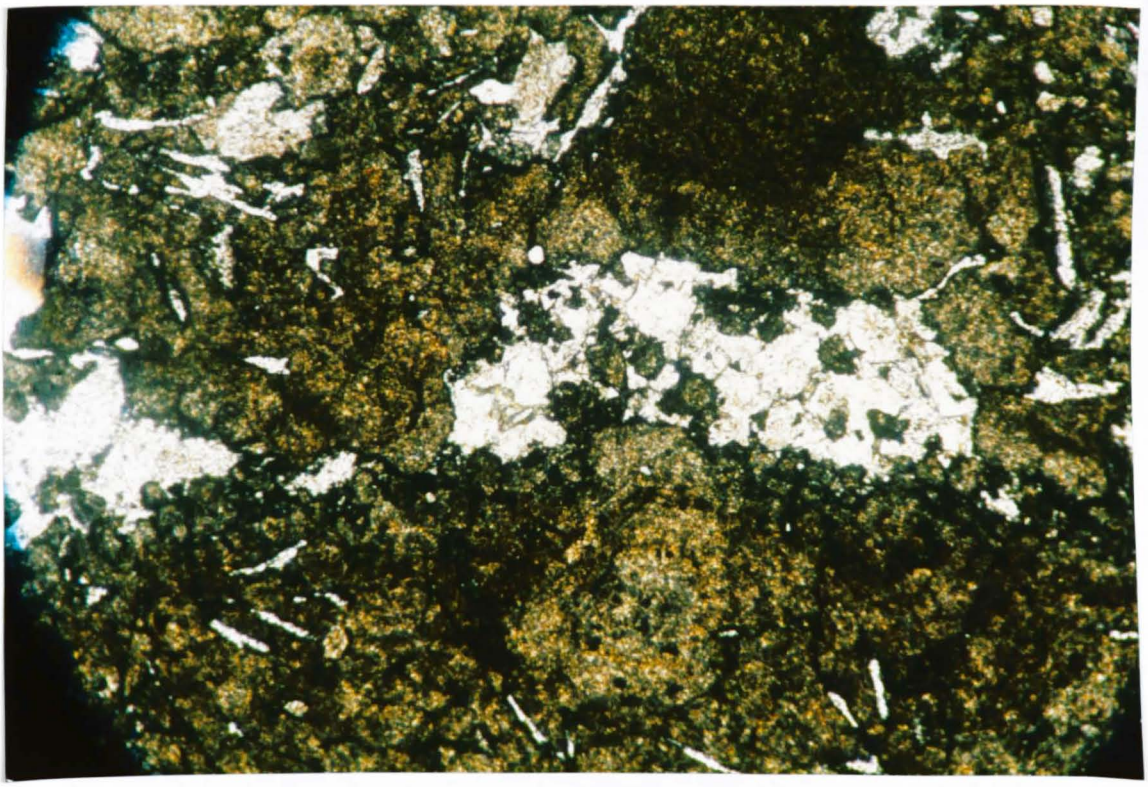
0.5mm



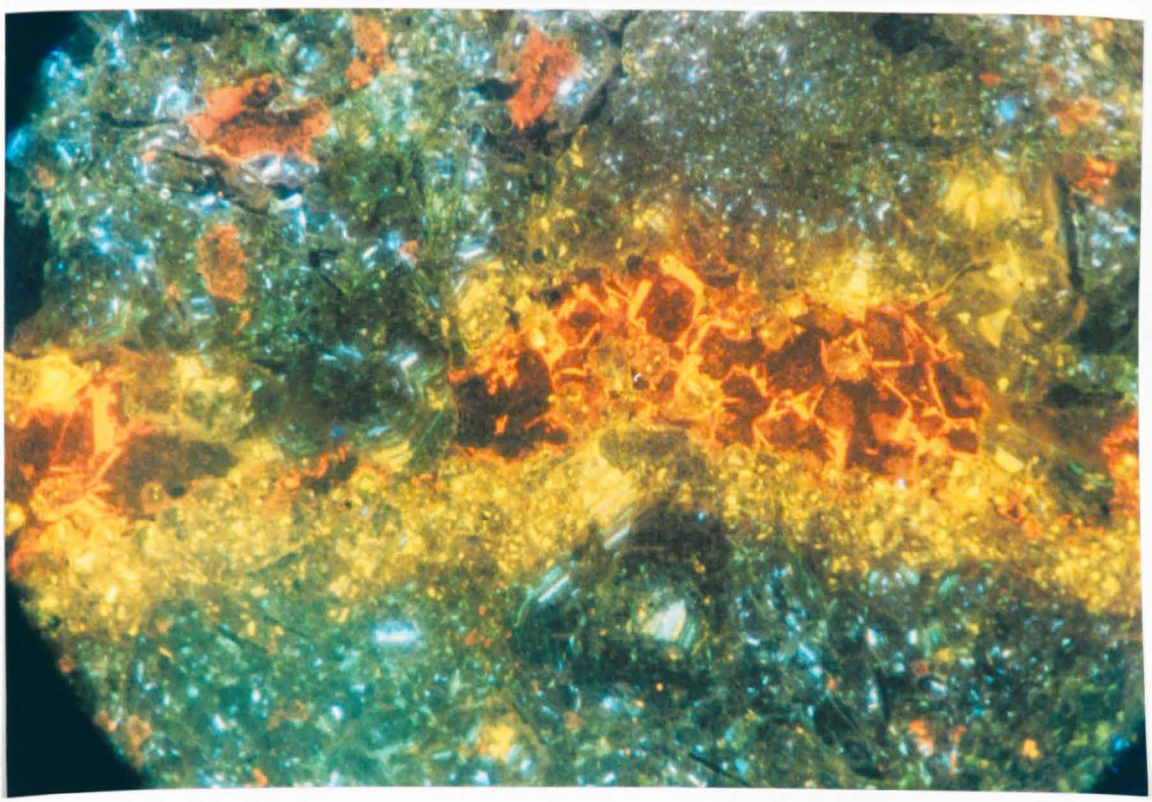
0.5mm

Plate 5.59a Transmitted light photograph illustrating massive sphalerite and lesser dolomite in 2-5 Lens (242S).

Plate 5.59b Cathodoluminescent light photograph of the same field of view as Plate 5.59a revealing earlier blue luminescent, zoned sphalerite and later yellow luminescent sphalerite, with the red luminescent dolomite mostly precipitated in spaces remaining after deposition of the yellow luminescent sphalerite.

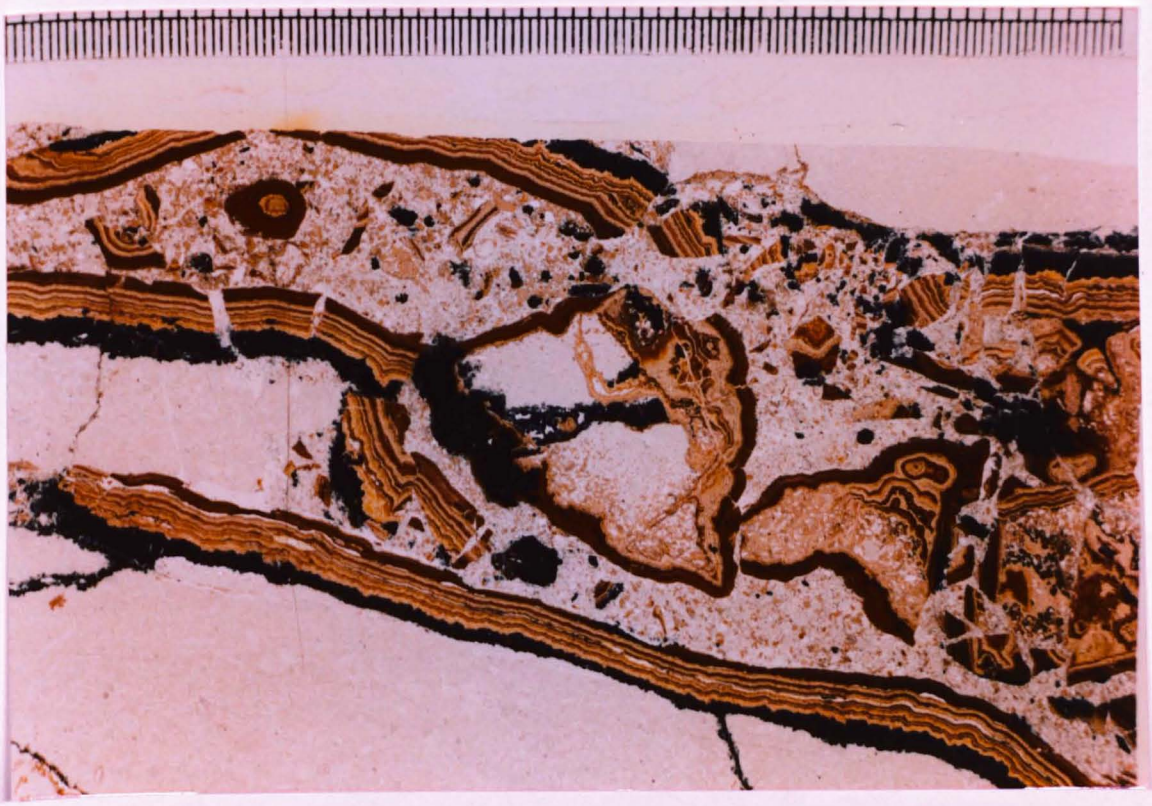


0.5mm



0.5mm

Plate 5.60 Transmitted light photograph illustrating a narrow sulphide vein in 2-5 Lens (242S) consisting of galena (black) and later rhythmically banded sphalerite overgrowths. The sulphide often breaks off to form clasts set in a dolomite/spahlerite matrix. Scale on the ruler is 1/2mm.



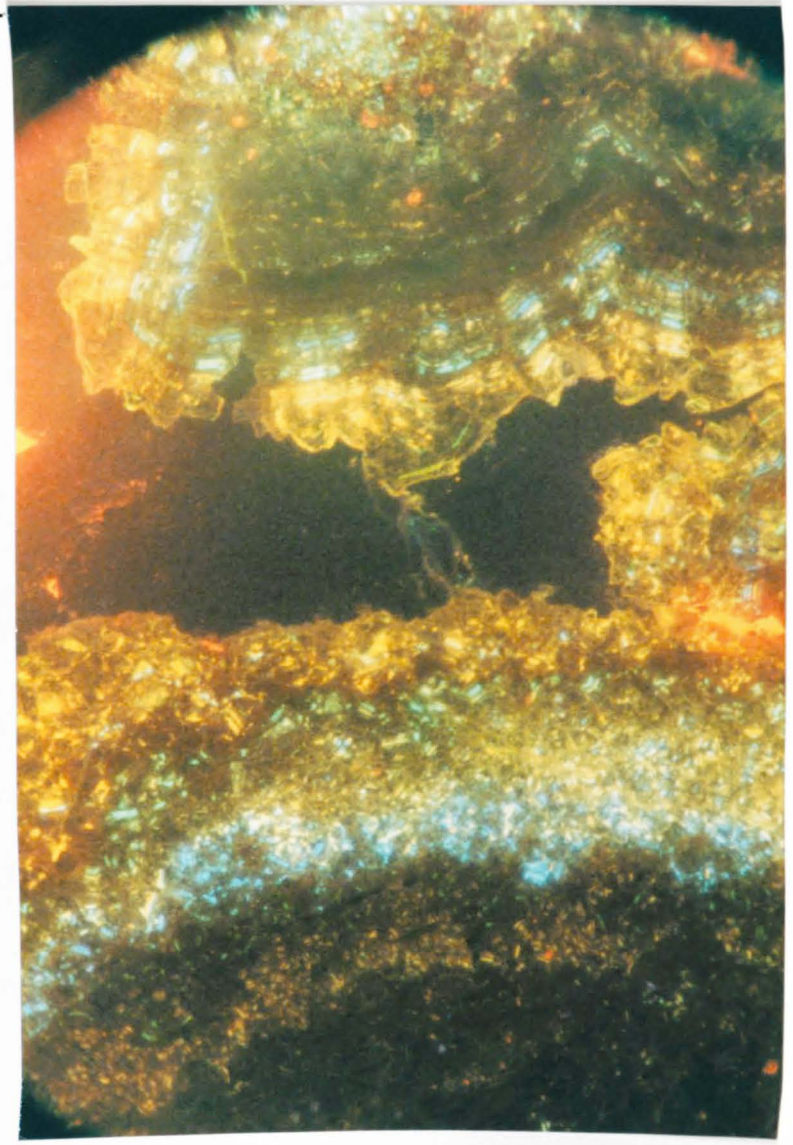
1cm

Plate 5.61 Cathodoluminescent light photograph illustrating small geopetal sphalerite sediments synchronous with rhythmically banded sphalerite above (2-5 Lens, 242S).

Plate 5.62 Transmitted light photograph illustrating a small, disrupted sphalerite geopetal in 2-5 Lens (242S). Scale on the ruler is 1/2mm.

1cm

View this way



0.5mm

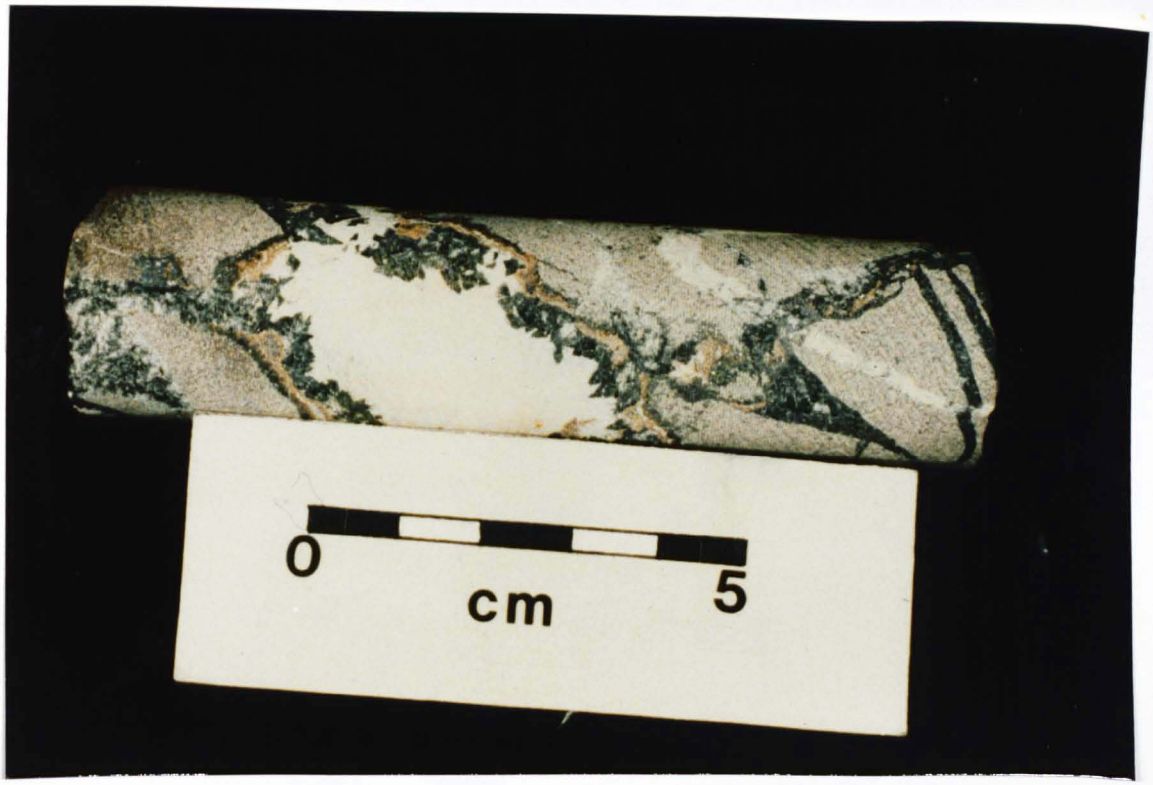
A84

Plate 5.63 Transmitted light photograph illustrating partial dissolution of the coarse, poorly zoned sphalerite prior to deposition of later rhythmically banded sphalerite (2-5 Lens, 242S).

0.2mm

Plate 5.64a Photograph of drillcore from 2-5 Lens illustrating dark (purple) dolomite rhombs.

Plate 5.64b Transmitted light photograph illustrating numerous microscopic inclusions of sulphosalts within the dolomite giving it the dark colouration (2-5 Lens).


0
cm
5

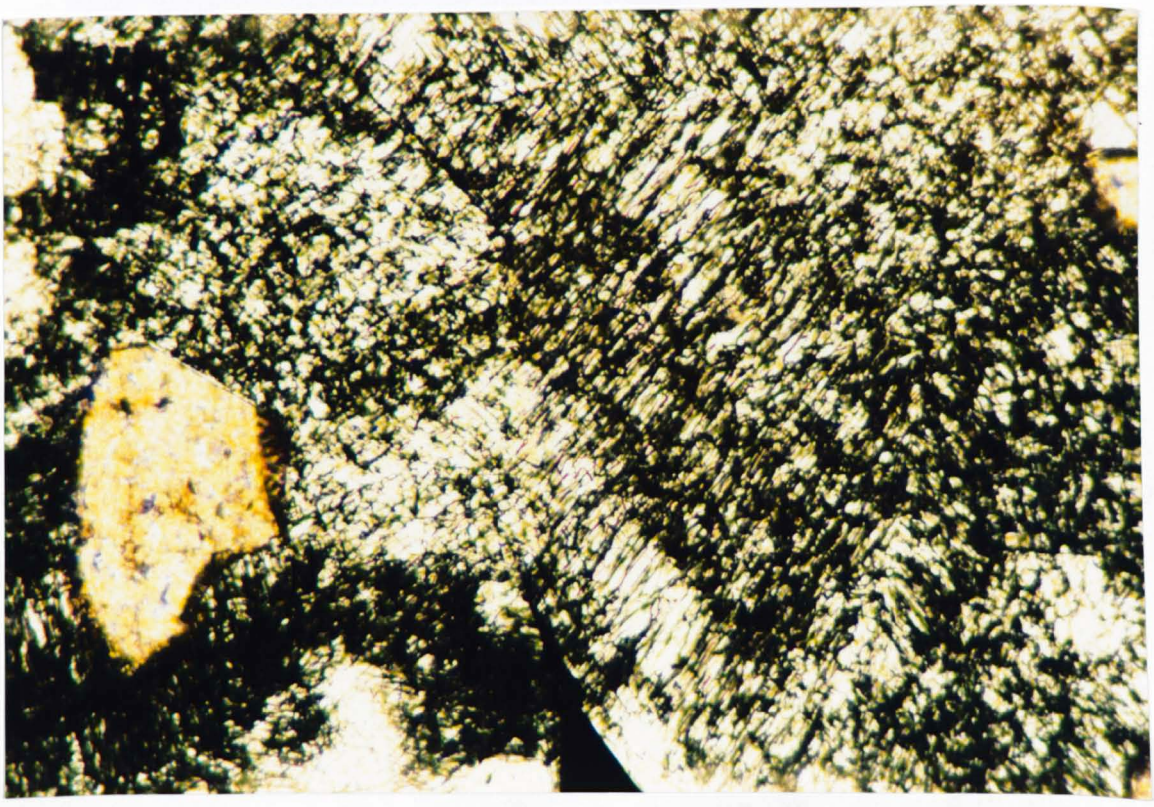
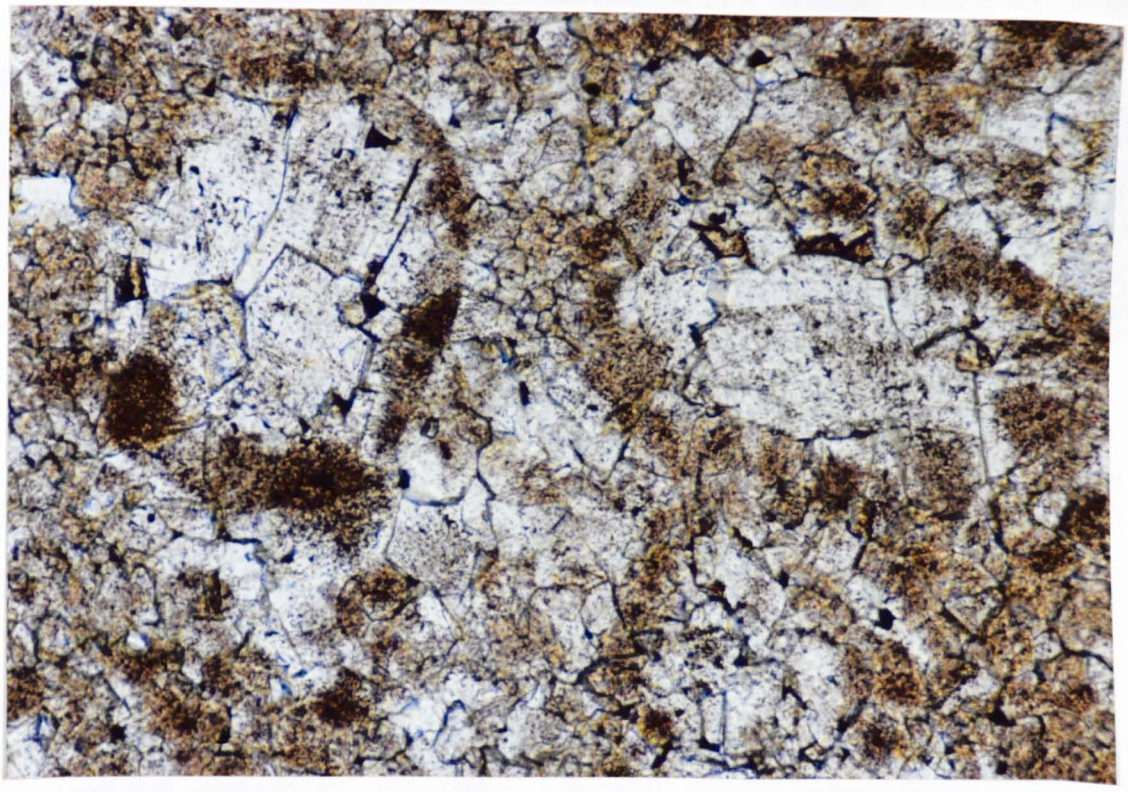
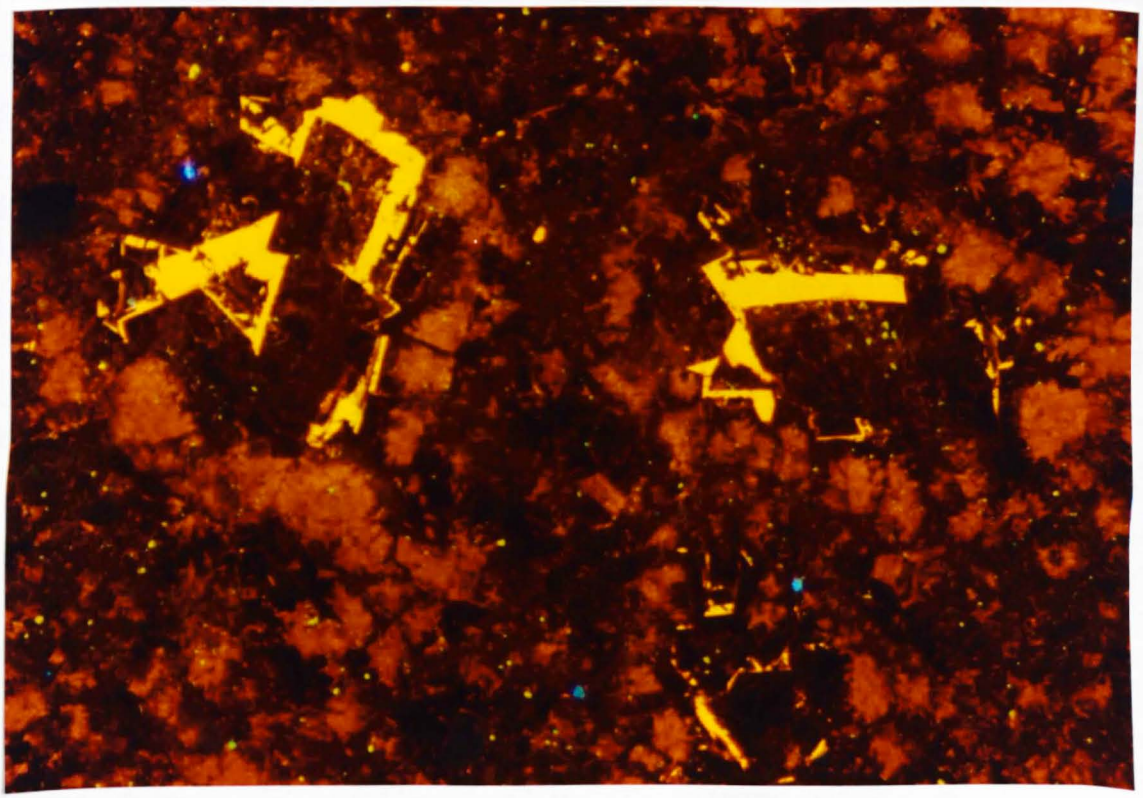

0.1mm

Plate 5.65a Transmitted light photograph illustrating ghost oolites within the dolomite host rock in parts of central 2-5 Lens (242S).

Plate 5.65b Cathodoluminescent light photograph of the same field of view as Plate 5.65a illustrating distinct generations of dolomite. The outermost margins of the oolites are dominated by Stage b) dolomite with corrosion of this stage by dark luminescent Stage c) which is also preferentially developed in the original matrix. The centres of the oolites contain Stage d). The yellow colouration to the zone in Stage d) is due to the picture being over-developed and this should infact be bright red.



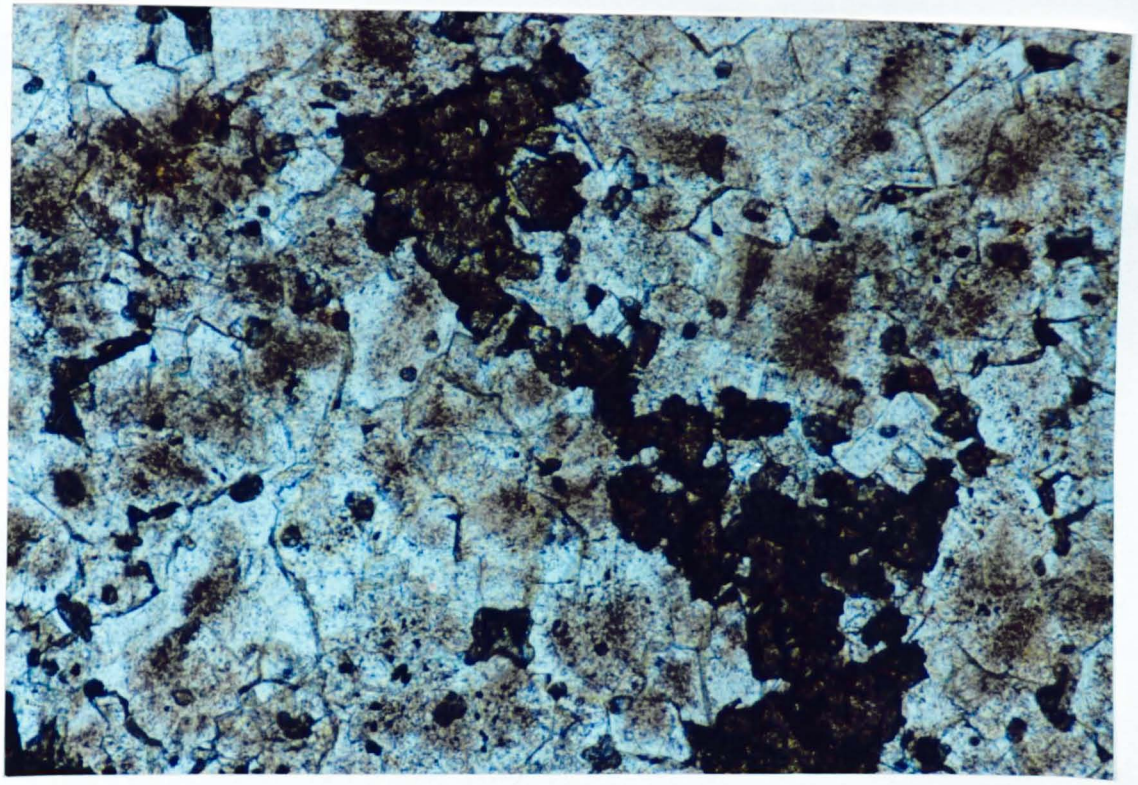
0.2mm



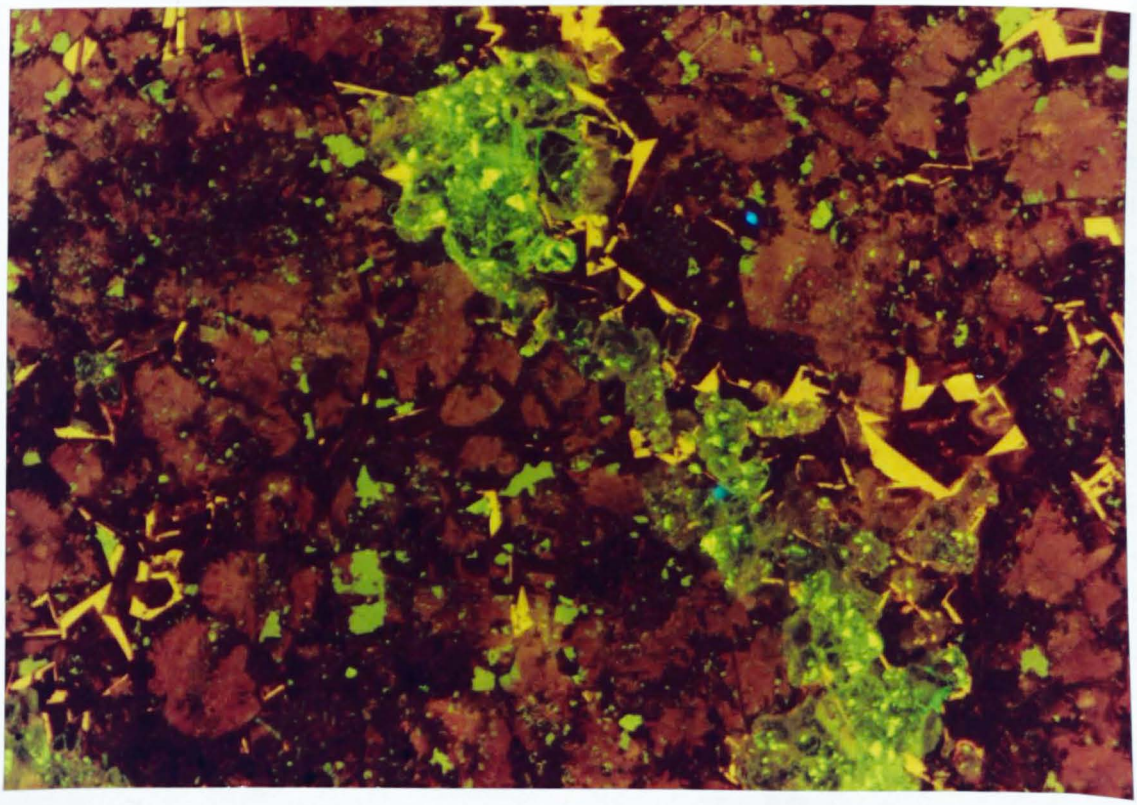
0.2mm

Plate 5.65c Transmitted light photograph illustrating the dolomite host rock in parts of central 2-5 Lens (242S) with dark sphalerite.

Plate 5.65d Cathodoluminescent light photograph of the same field of view as Plate 5.65c illustrating the same generations of dolomite seen in Plate 5.65b. Note that the sphalerite coincides with the development of Stage d) dolomite.



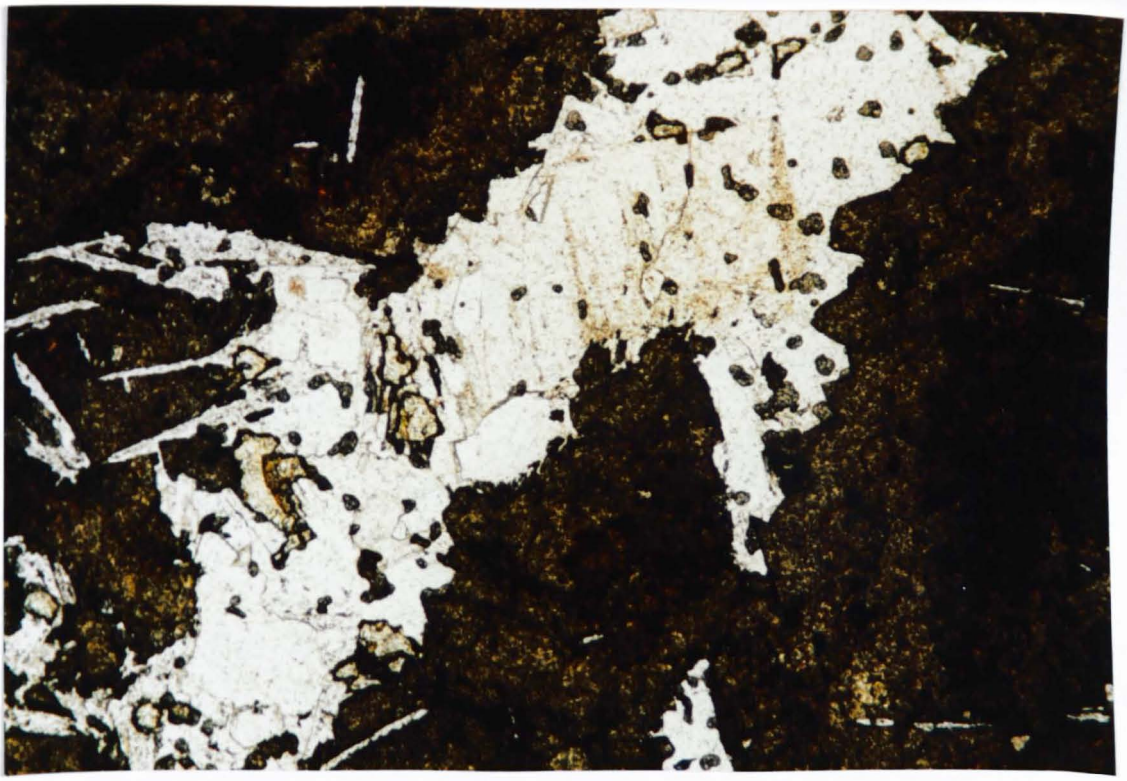
0.2mm



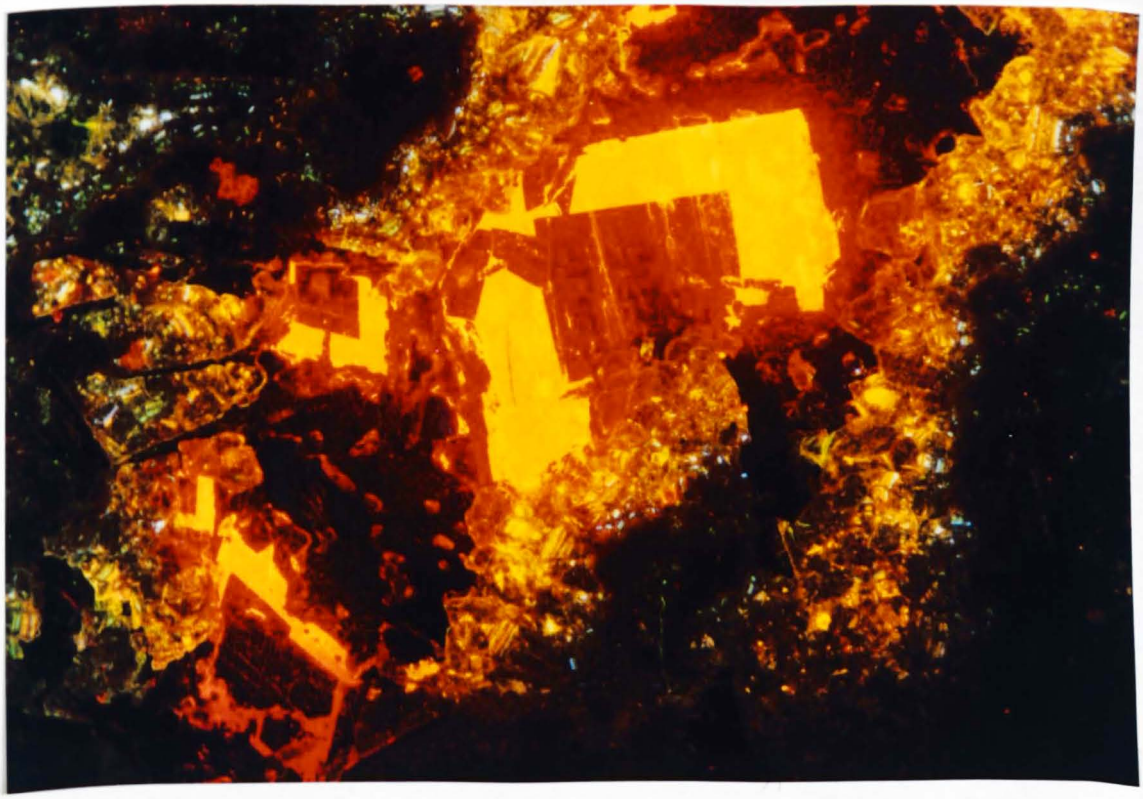
0.2mm

Plate 5.66a Transmitted light photograph illustrating sphalerite within the massive sulphides, with late-stage dolomite.

Plate 5.66b Cathodoluminescent light photograph of the same field of view as Plate 5.66a, showing that the dolomite post-dating the sphalerite is Stage d) dolomite.



0.2mm



0.2mm

Plate 5.67 Photograph from an underground heading in 2-5 Lens (242S) illustrating fracture-fill/breccia mineralization. Field of view is about 1.5m across.

Plate 5.68 Photograph of a handspecimen from the heading illustrated in Plate 5.67, showing breccia mineralization. Coin for scale.

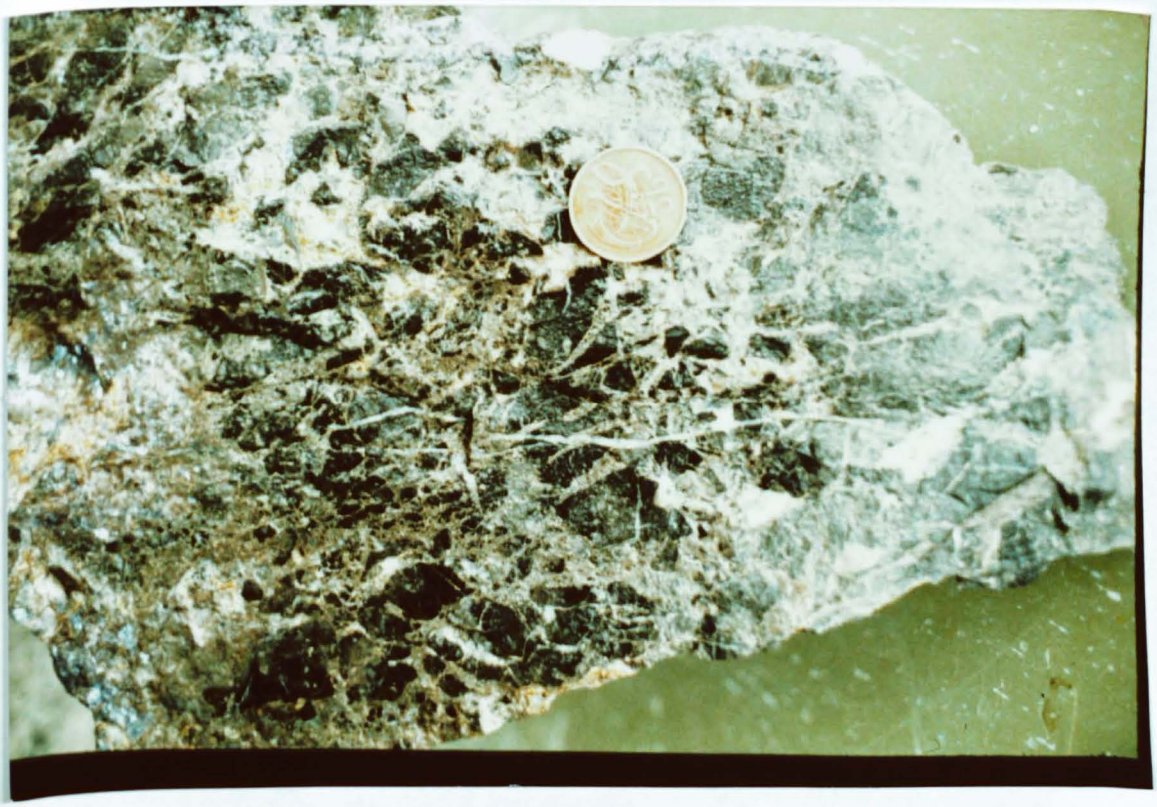
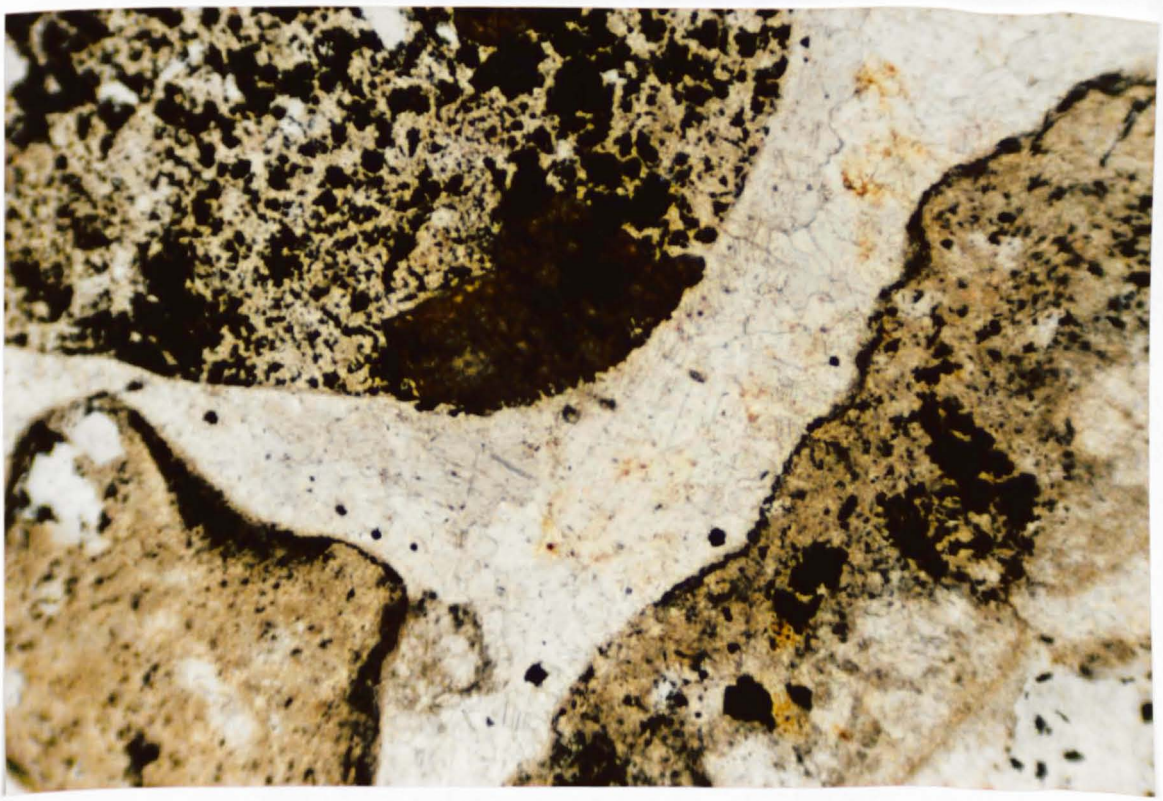


Plate 5.69 Photograph from an underground heading in 1-5 Lens illustrating bedding-parallel sulphide layers linked by cross-cutting breccias.

Plate 5.70 Photograph from an underground heading in 1-5 Lens (173N) illustrating a collapse breccia with clasts of overlying Bottom Dark Marker within the underlying pale calcarenite.

Plate 5.71 Photograph from an underground heading in 3-5 Lens illustrating a cross-cutting sulphide vein consisting of coarse galena and rhythmic-crustiform sphalerite.

Plate 5.72 Transmitted light photograph illustrating small intraclasts in the 3 Lens micro-conglomerates containing eroded, zoned sphalerite crystals and implying that the mineralization in this example occurred prior to the ripping-up of the intraclasts.



0.2mm

Plate 5.73 Photograph from an underground heading in 2-5 Lens west (1190 haulage) illustrating the undulating, sharp contacts between a bedding-parallel sulphide horizon (2-5 Lens FW) and the surrounding host rocks.

Plate 5.74 Photograph of a hand specimen from 2-4 Lens (252/252S) illustrating a collapsed clast of sphalerite rich, stringer-type mineralization which has fallen into the massive sulphides below.

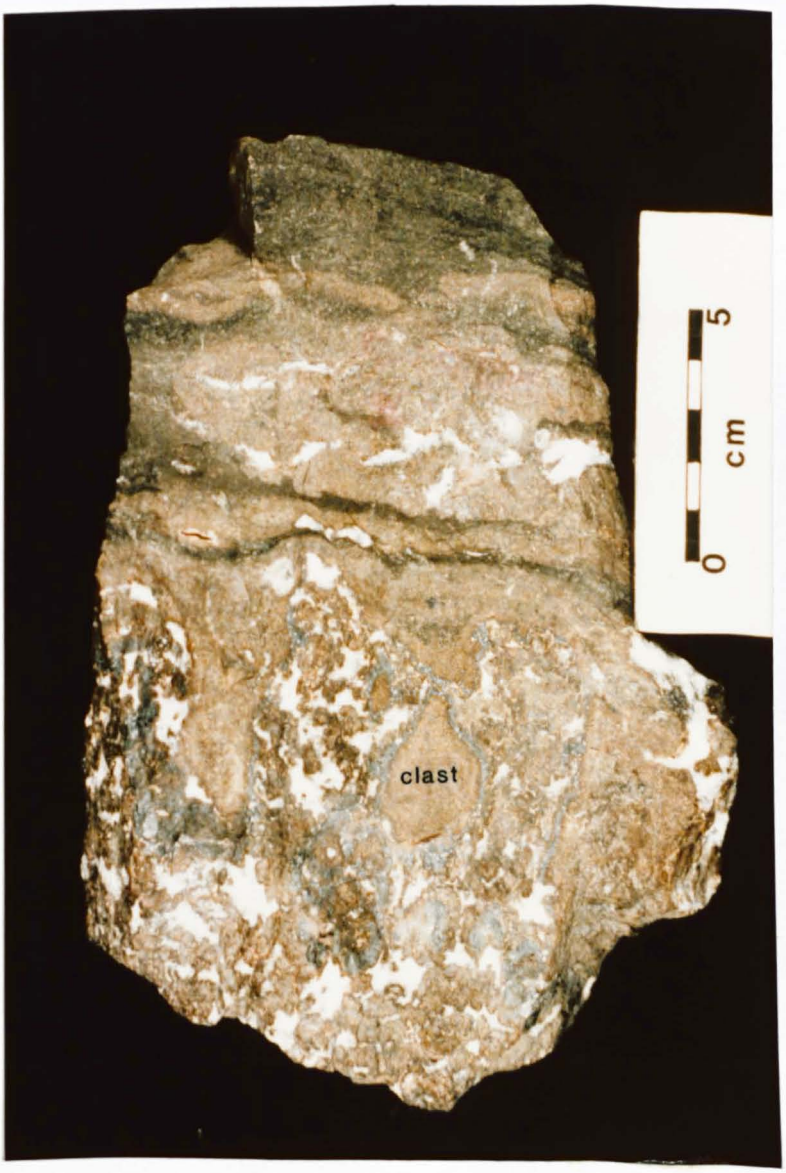
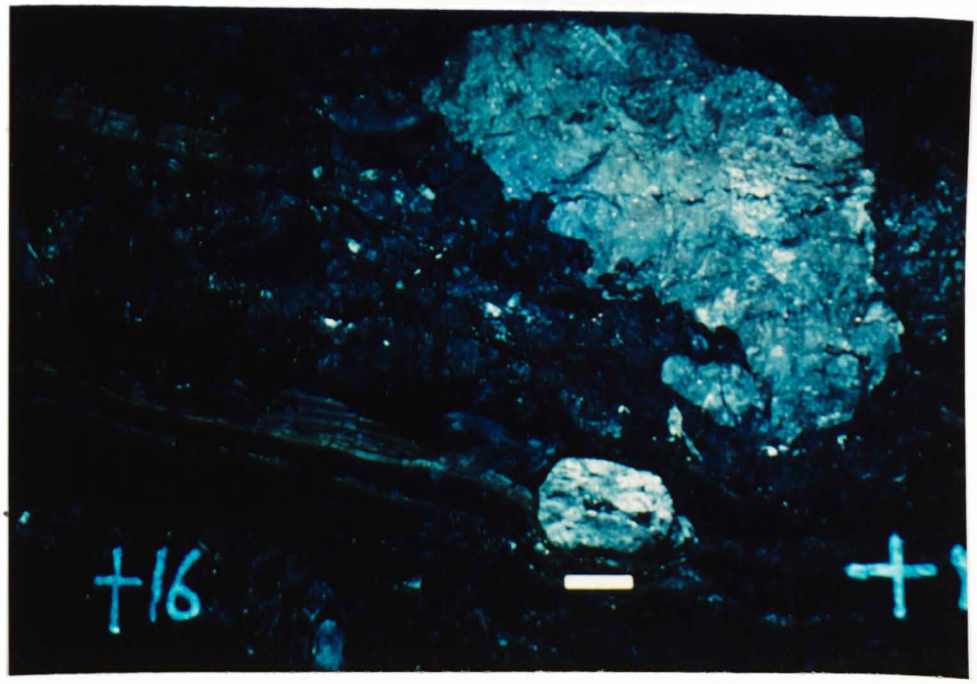

clast
0
5
cm

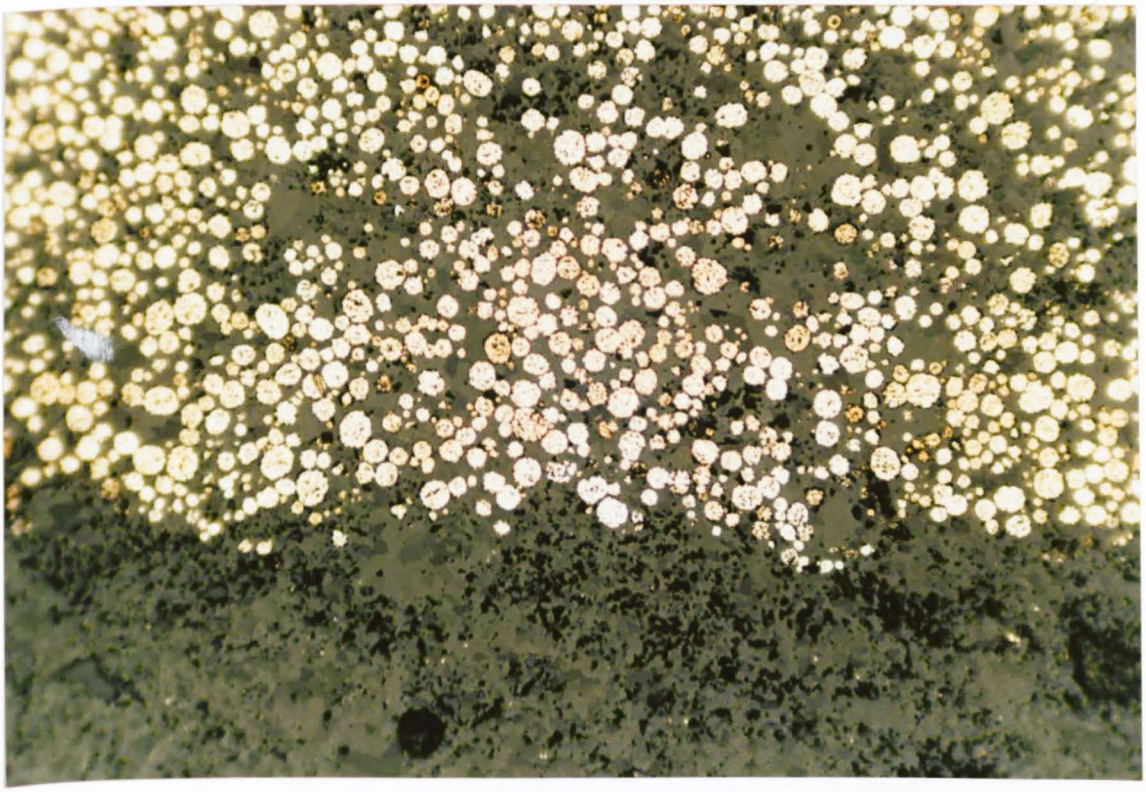
Plate 5.75 Photograph from an underground heading in the Boulder Conglomerate illustrating clasts of Waulsortian mudbank deforming laminated pyrite.

Plate 5.76 Photograph of a hand specimen taken from the Boulder Conglomerate (2 Zone upper) illustrating laminated pyrite.


+16


0
cm
5

Plate 5.77 Reflected light photograph of a polished section prepared from part of the hand specimen in Plate 5.76, showing that the pyrite layers are comprised of framboids.



0.2mm

Plate 5.78a Photograph from an underground heading in the Boulder Conglomerate (3 Zone) illustrating clasts of mineralized and unmineralized Pale Beds.

Plate 5.78b Photograph from an underground heading in the Boulder Conglomerate/Conglomerate Group Ore (3 Zone access drift, 1405 level) illustrating pyrite deposited around clasts in a "breccia" of Pale Beds calcarenites and lesser Waulsortian mudbank.