

Photomicrographs of Rock-Forming Minerals

Giles Droop

A selection of images, chosen for visual impact, showing a variety of igneous and metamorphic minerals under the microscope.

N.B. Some images show minerals with their true absorption colours in 'plane-polarised light', while others show false colours (interference colours) under 'crossed polars'.

Abbreviations:

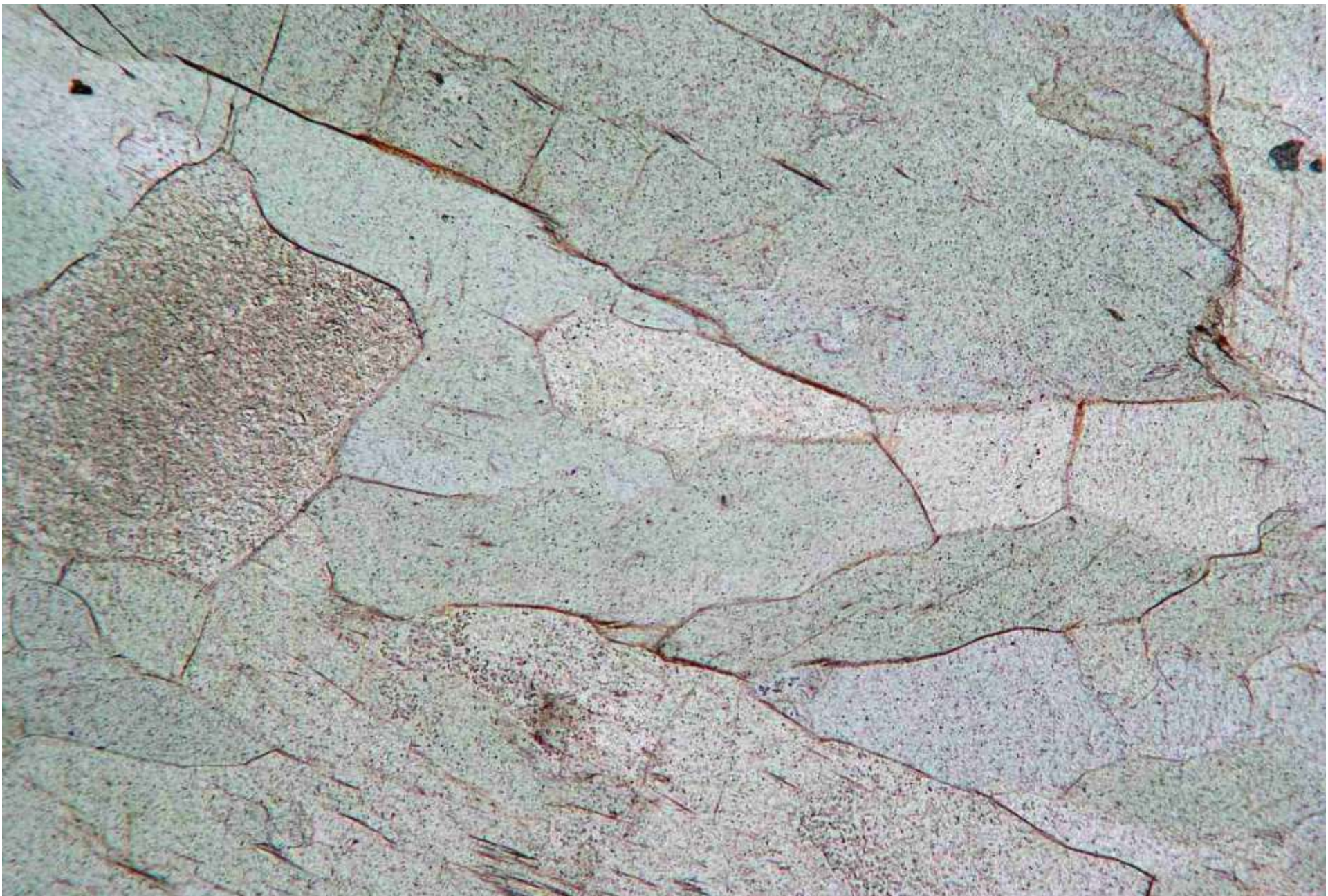
LP: Low-power magnification. Long axis of field of view = 5mm

MP: Medium-power magnification. Long axis of field of view = 2mm

HP: High-power magnification. Long axis of field of view = 0.8mm

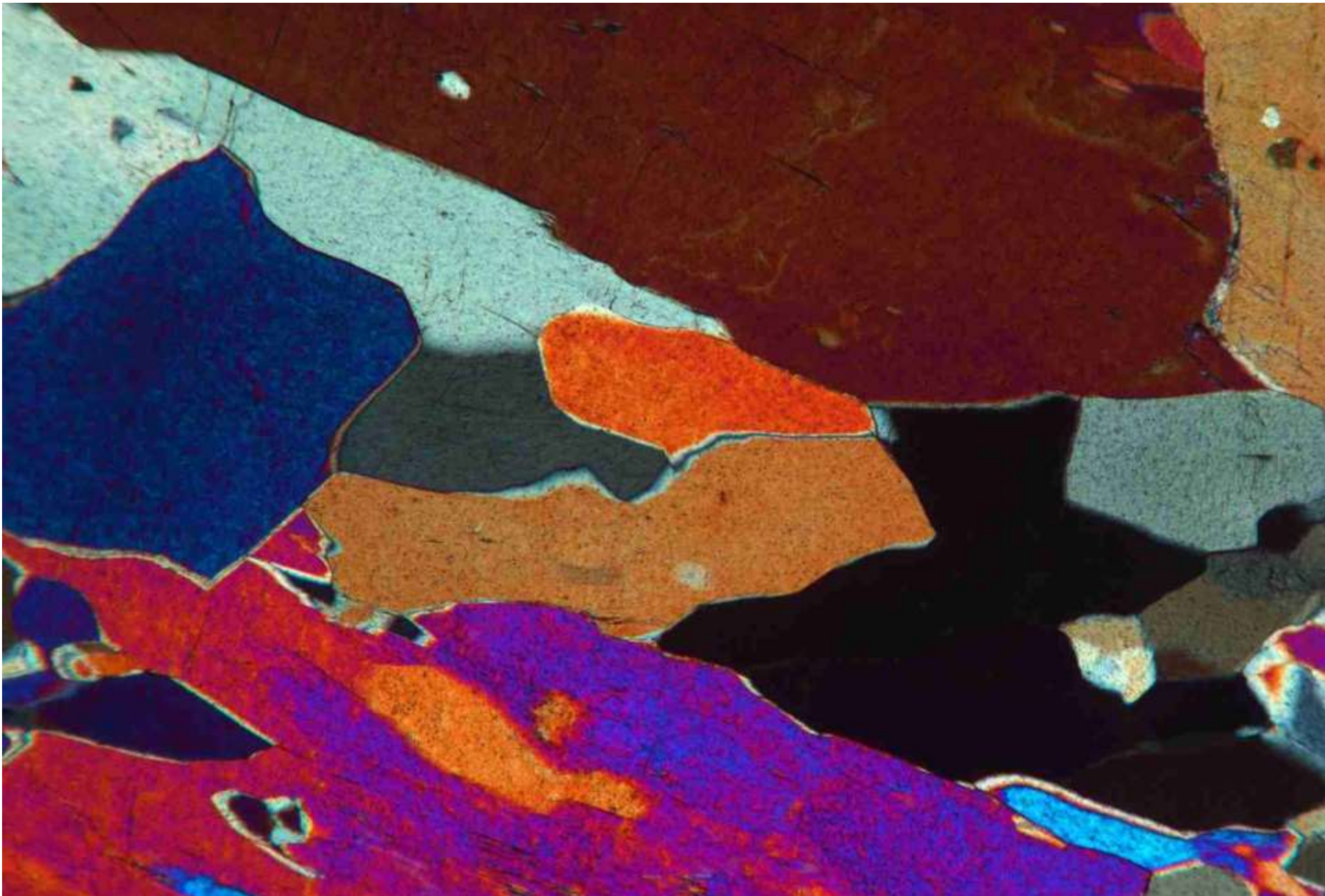
ppl: Plane-polarised light xpol: Crossed polars var: Variety

Actinolite: monomineralic aggregate



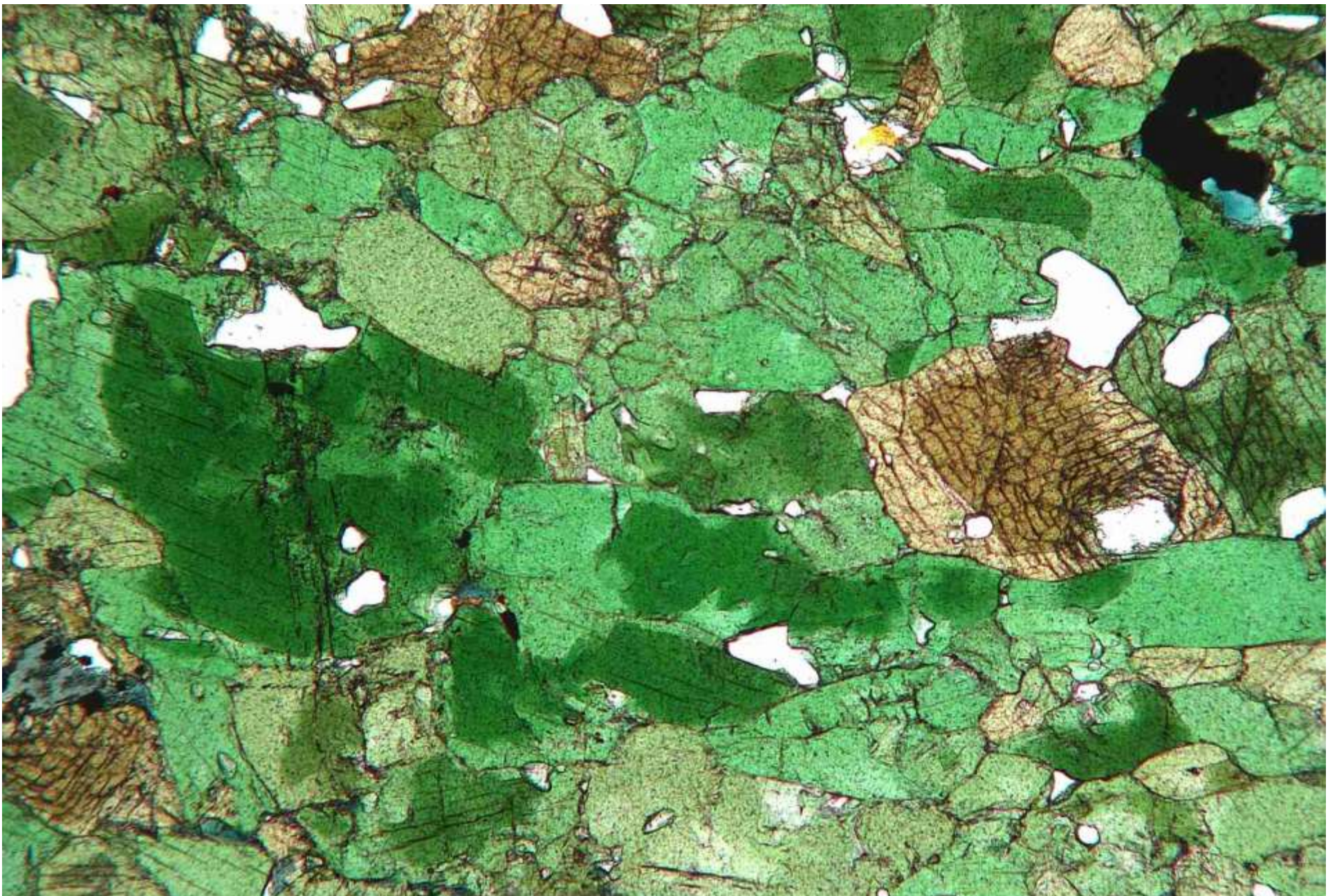
Actinolite granofels. South Harris, NW Scotland. ppl MP

Same view under crossed polars



Actinolite granofels. South Harris, NW Scotland. xpol MP

Zoned aegirine with glaucophane (blue), quartz (colourless) and opaques



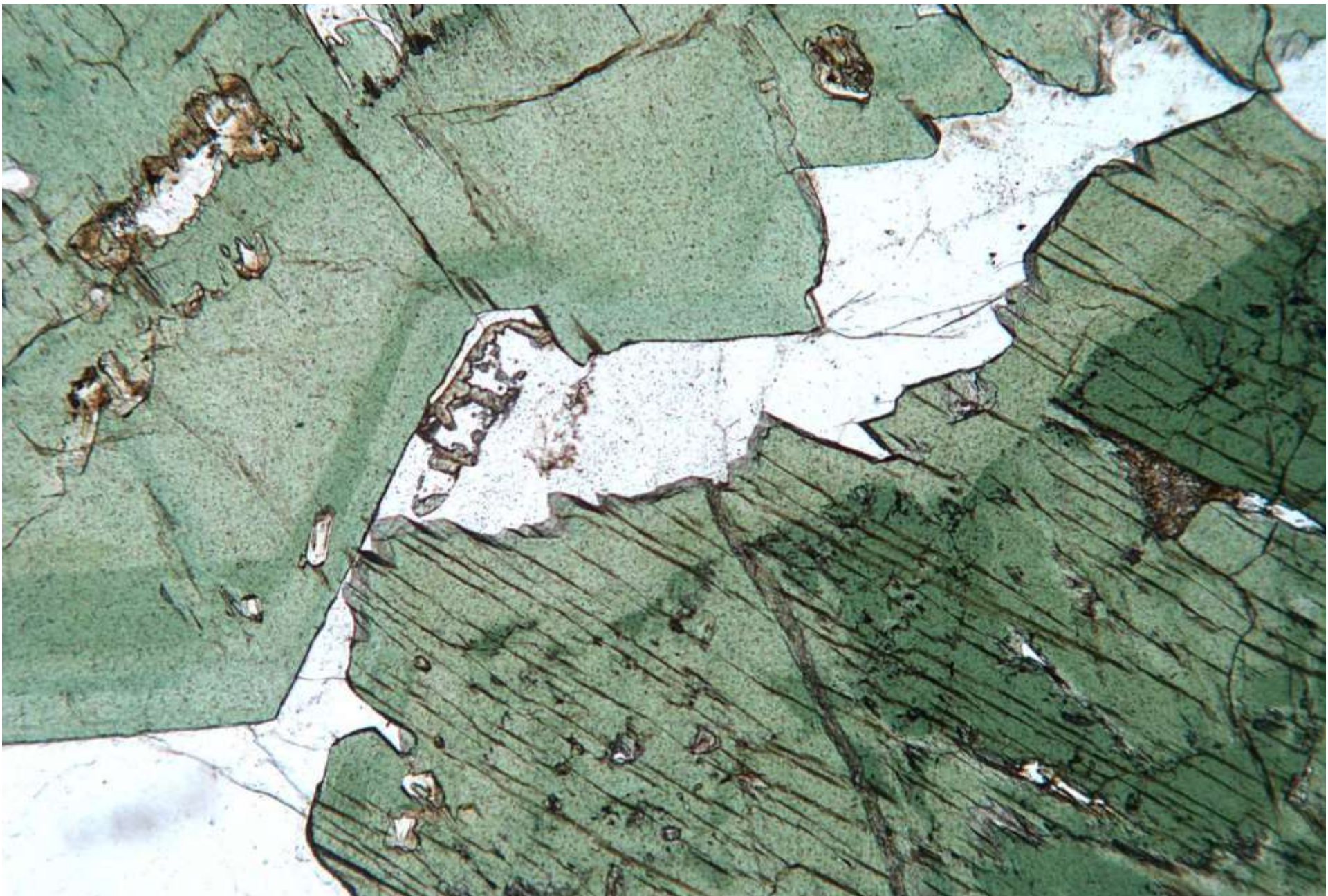
Garnet aegirine quartzite. Cervinia, N Italy. ppl MP

Aegirine (green) with orthoclase (colourless)



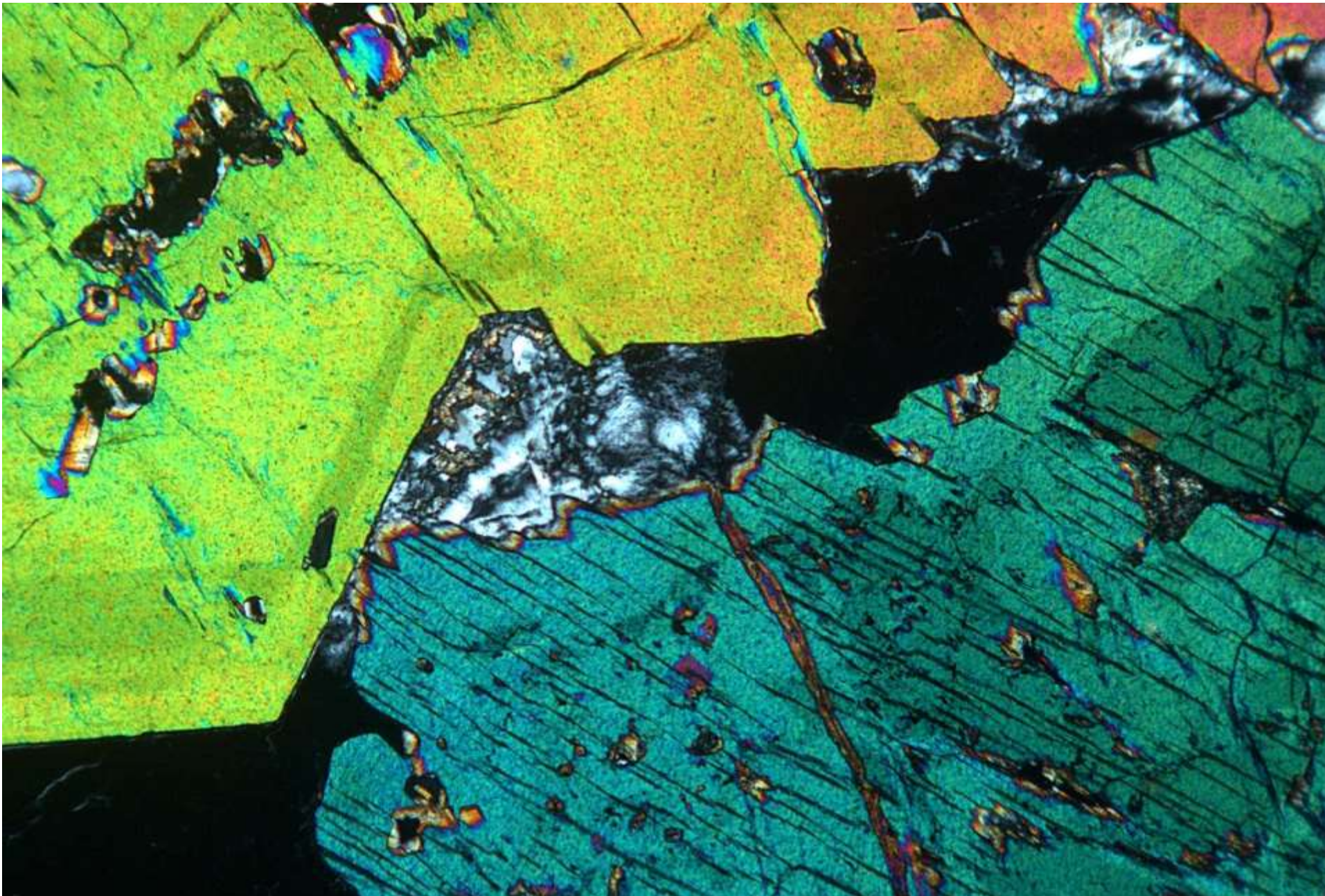
Syenite. Locality unknown. ppl MP

Aegirine (green) with sodalite (colourless)



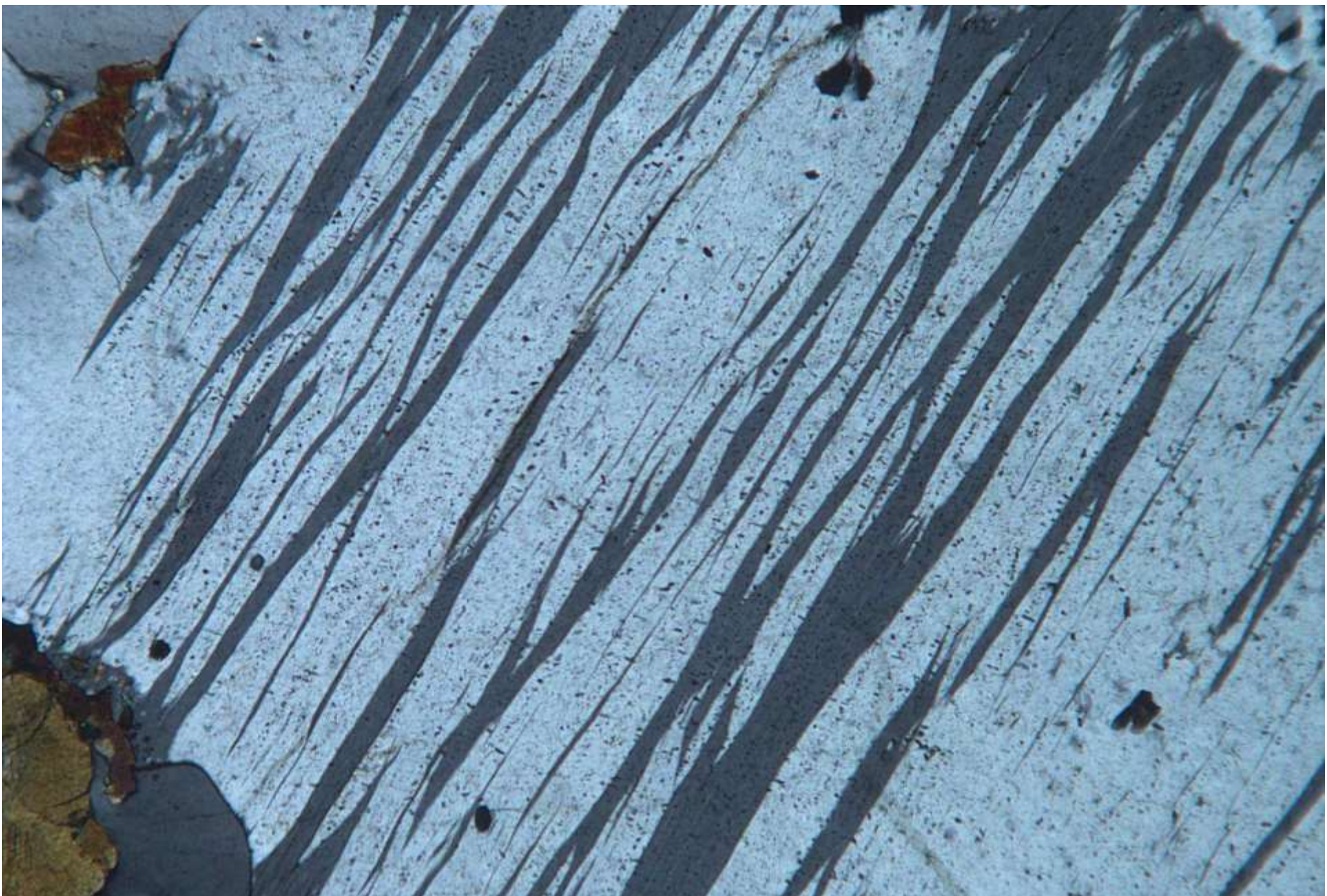
Sodalite syenite. Ilimaussaq, Greenland. ppl MP

Same view under crossed polars



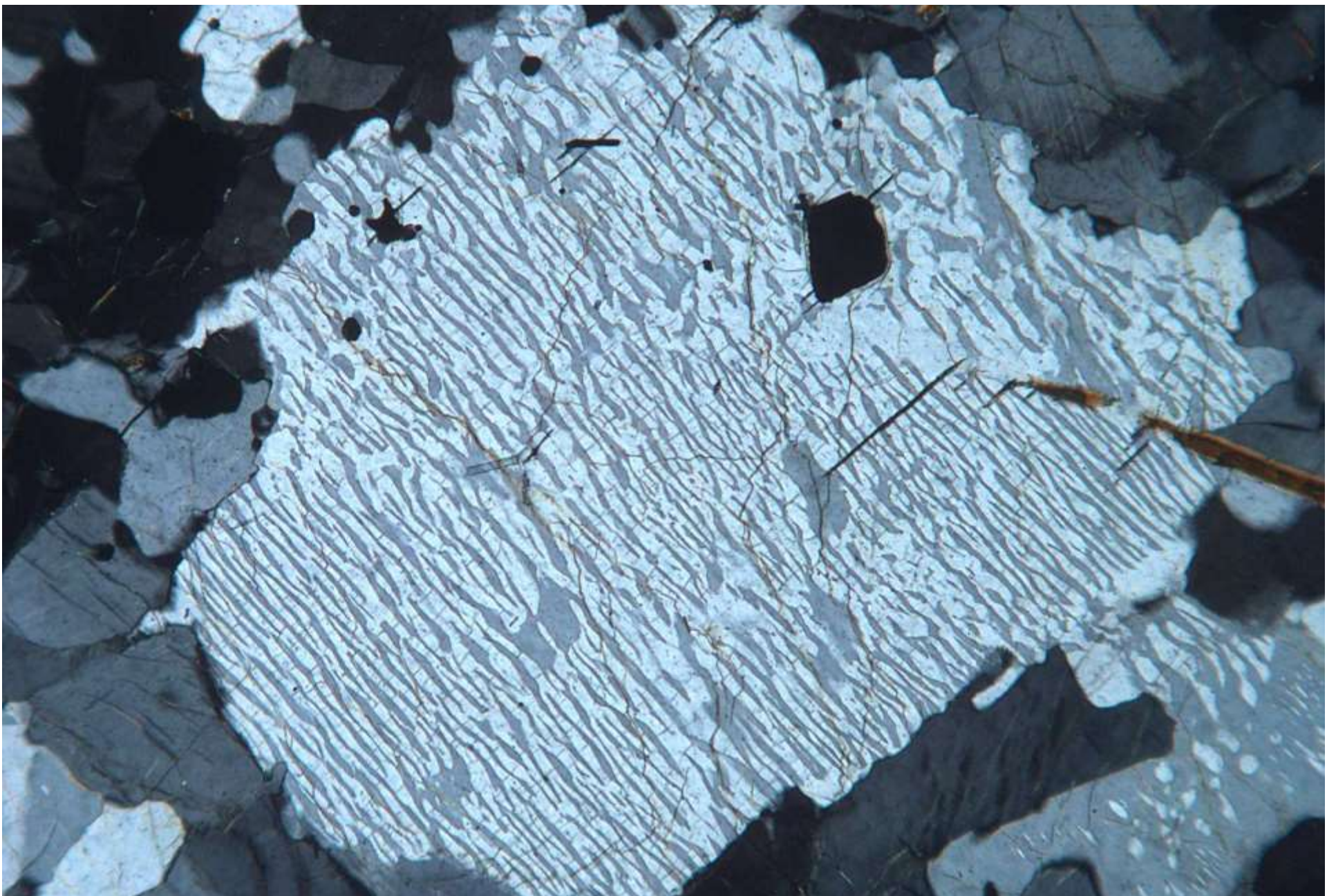
Sodalite syenite. Ilimaussaq, Greenland. xpol MP

Alkali feldspar (var. mesoperthite) showing exsolution lamellae



Pyroxene granite ('charnockite'). Hopen, Lofoten, Norway. xpol MP

Alkali feldspar (var. mesoperthite) showing exsolution lamellae



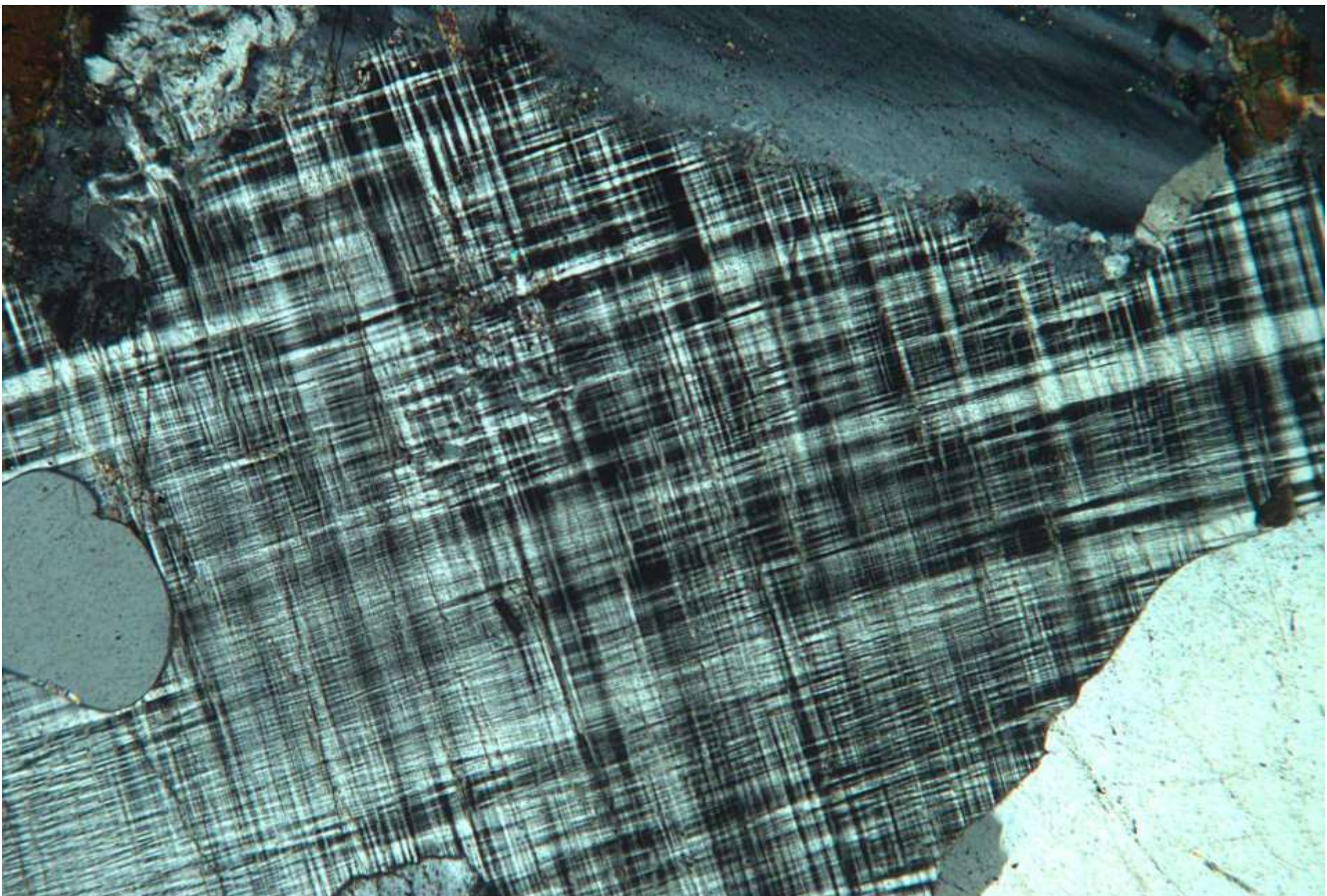
Syenodiorite ('mangerite'). Hovden, Lofoten, Norway. xpol MP

Micrographic intergrowth of alkali feldspar (orthoclase) and quartz



Microgranite. Beinn an Dubhaich, Skye, Scotland. xpol MP

Alkali feldspar (var. microcline), showing multiple twinning, with quartz



Granite. South Dakota, USA. xpol MP

Andalusite, with zonally distributed quartz inclusions, in biotite



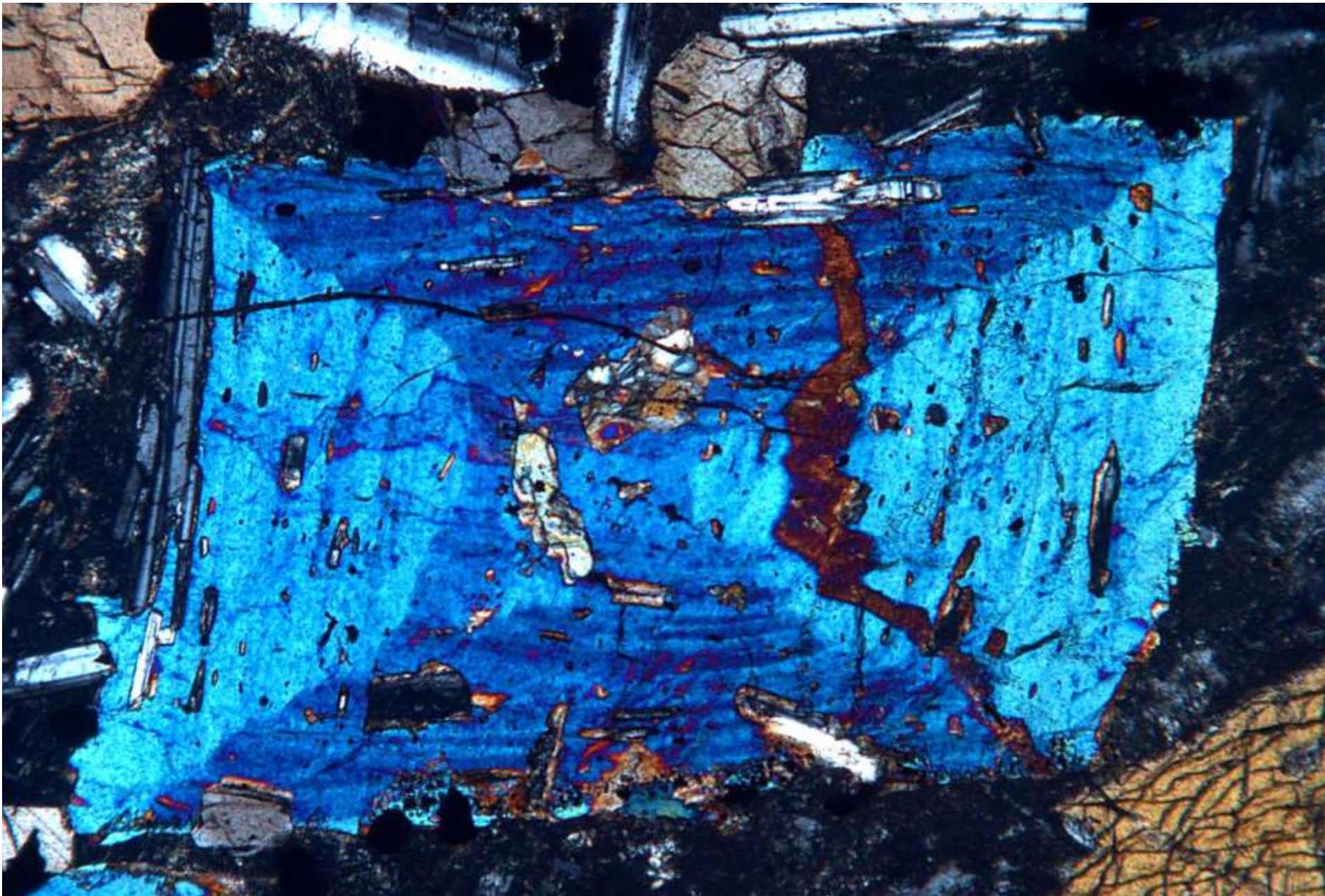
Andalusite cordierite mica schist. Boyndie Bay, Scotland. ppl MP

Augite (var. titanaugite) with sector zoning. Colourless crystals: plagioclase



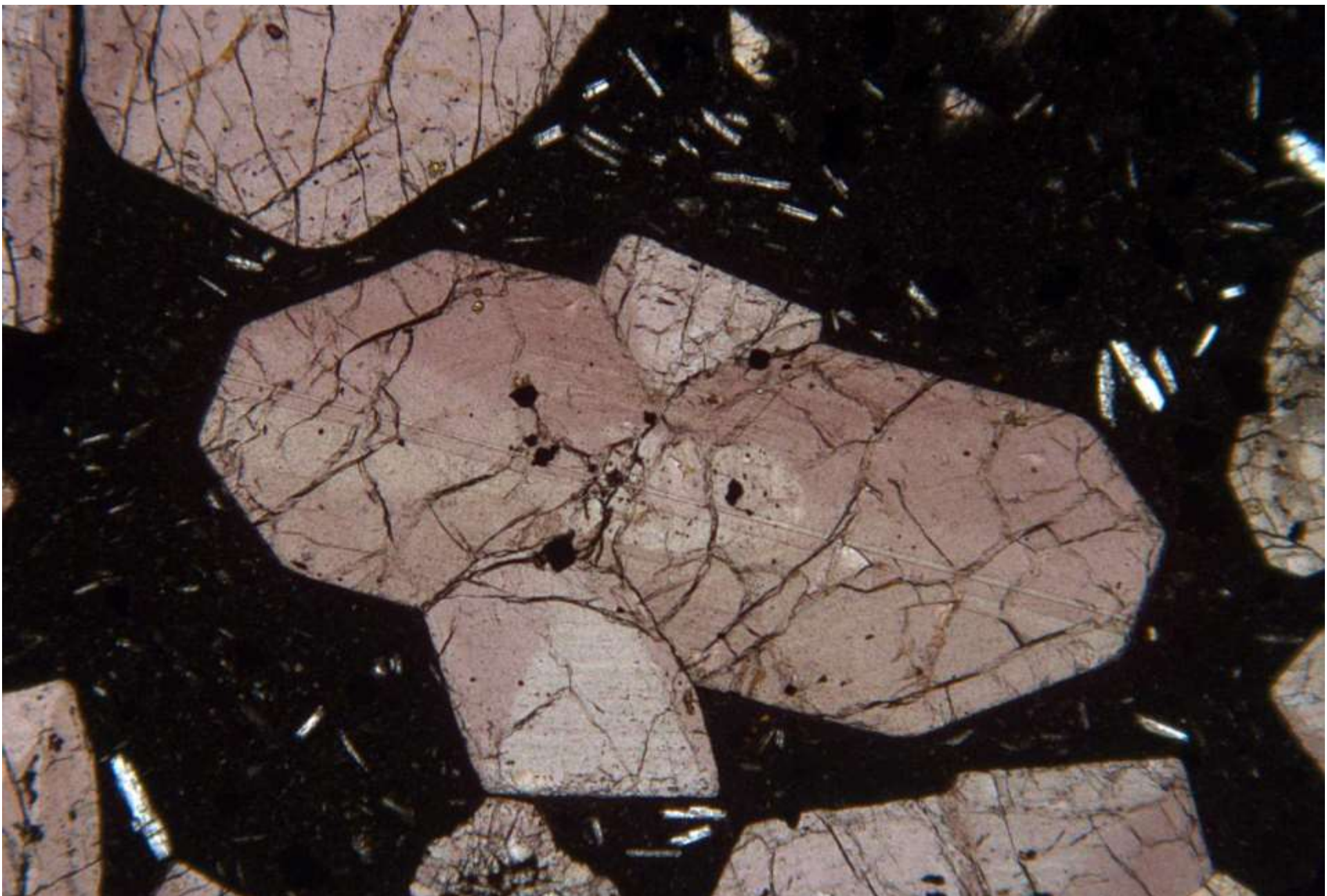
Syenogabbro ('essexite'). Locality unknown. ppl MP

Same view under crossed polars



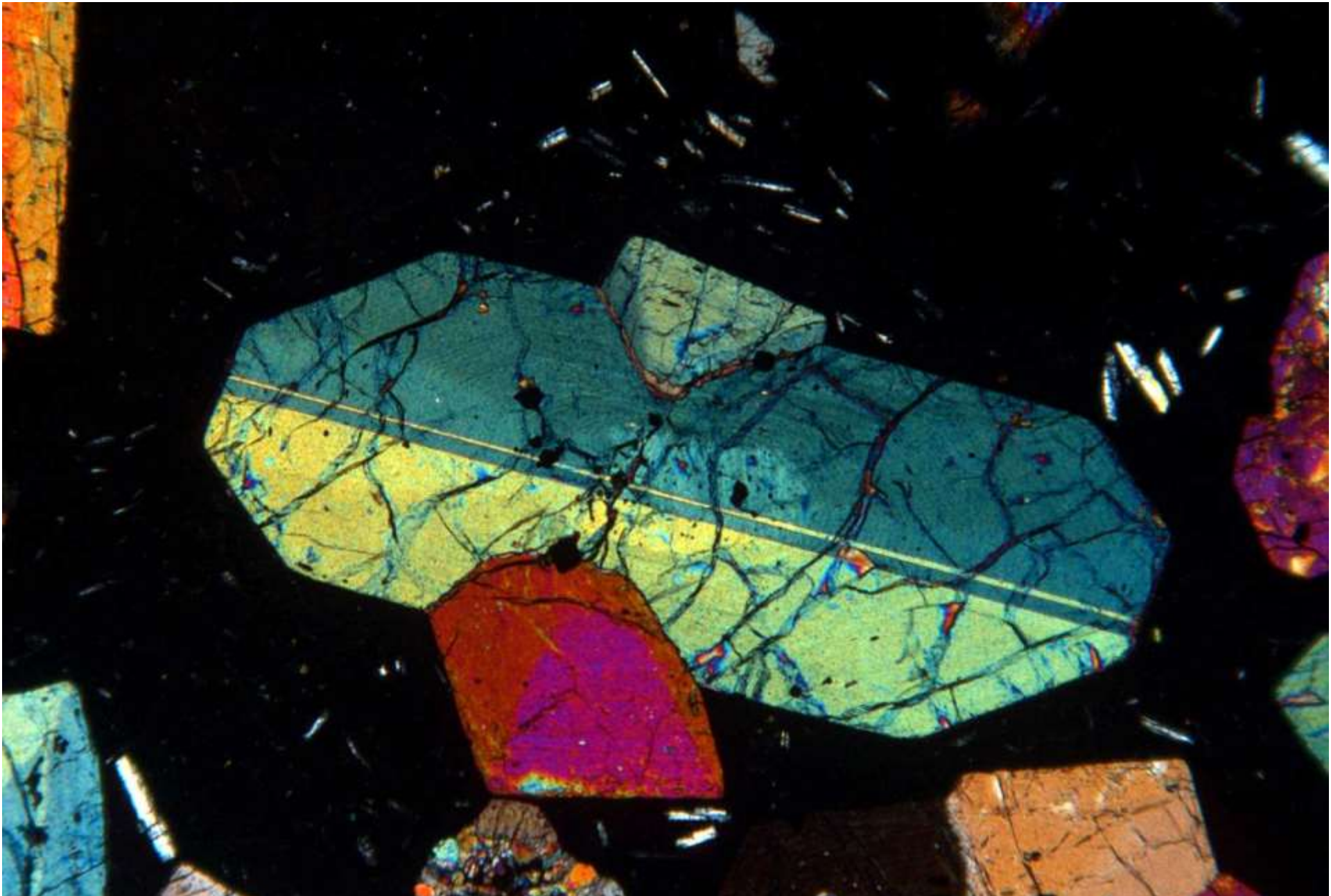
Syenogabbro ('essexite'). Locality unknown. xpol MP

Augite (var. titanaugite), with twinning and zoning, and plagioclase (colourless) in glass



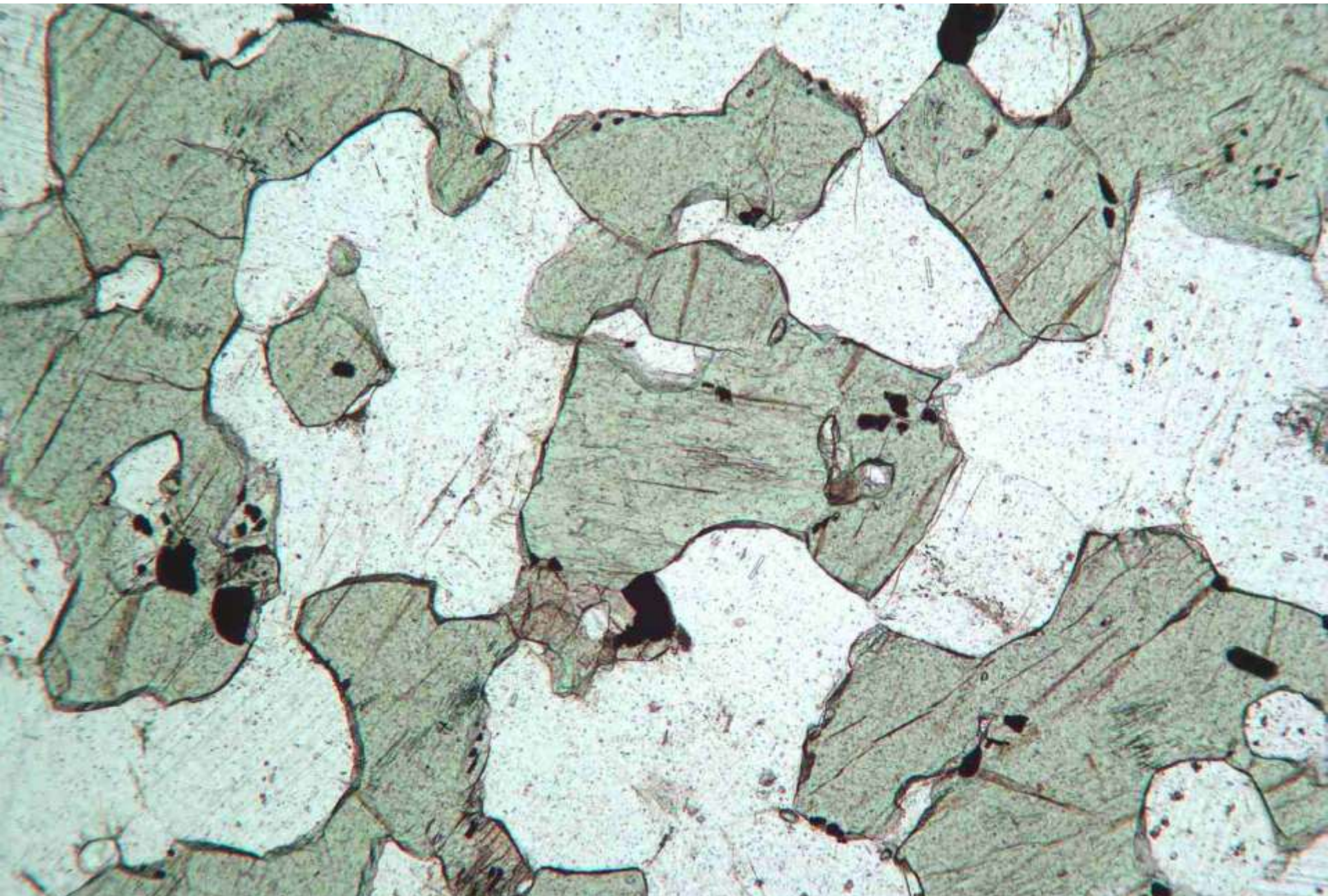
Limburgite. Kaiserstuhl, Germany. ppl LP

Same view under crossed polars



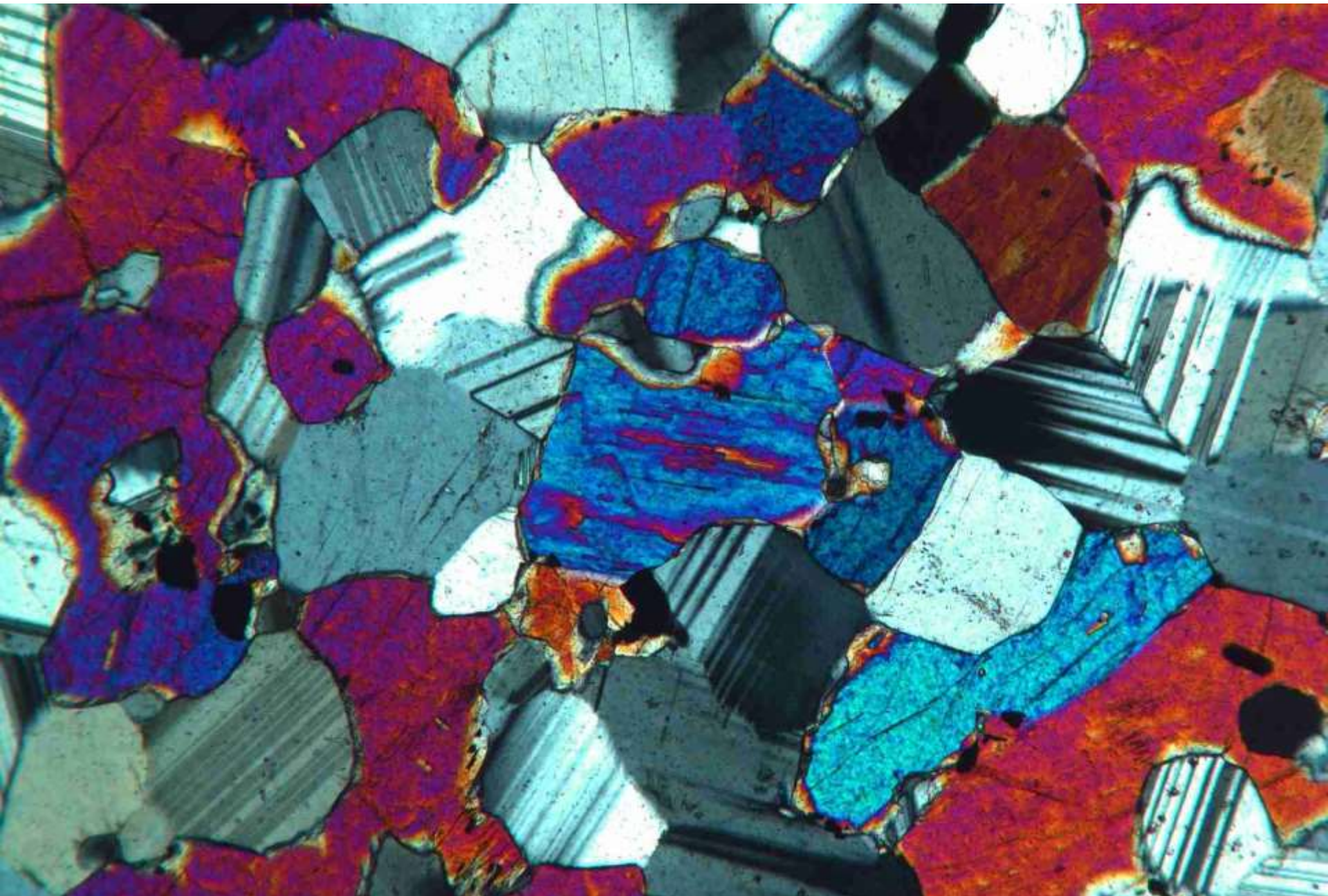
Limburgite. Kaiserstuhl, Germany. xpol LP

Augite (green) with plagioclase (colourless)



Pyroxene plagioclase granofels. Bangala Dam, Zimbabwe. ppl MP

Same view under crossed polars.



Pyroxene plagioclase granofels. Bangala Dam, Zimbabwe. xpol MP

Aligned flakes of biotite

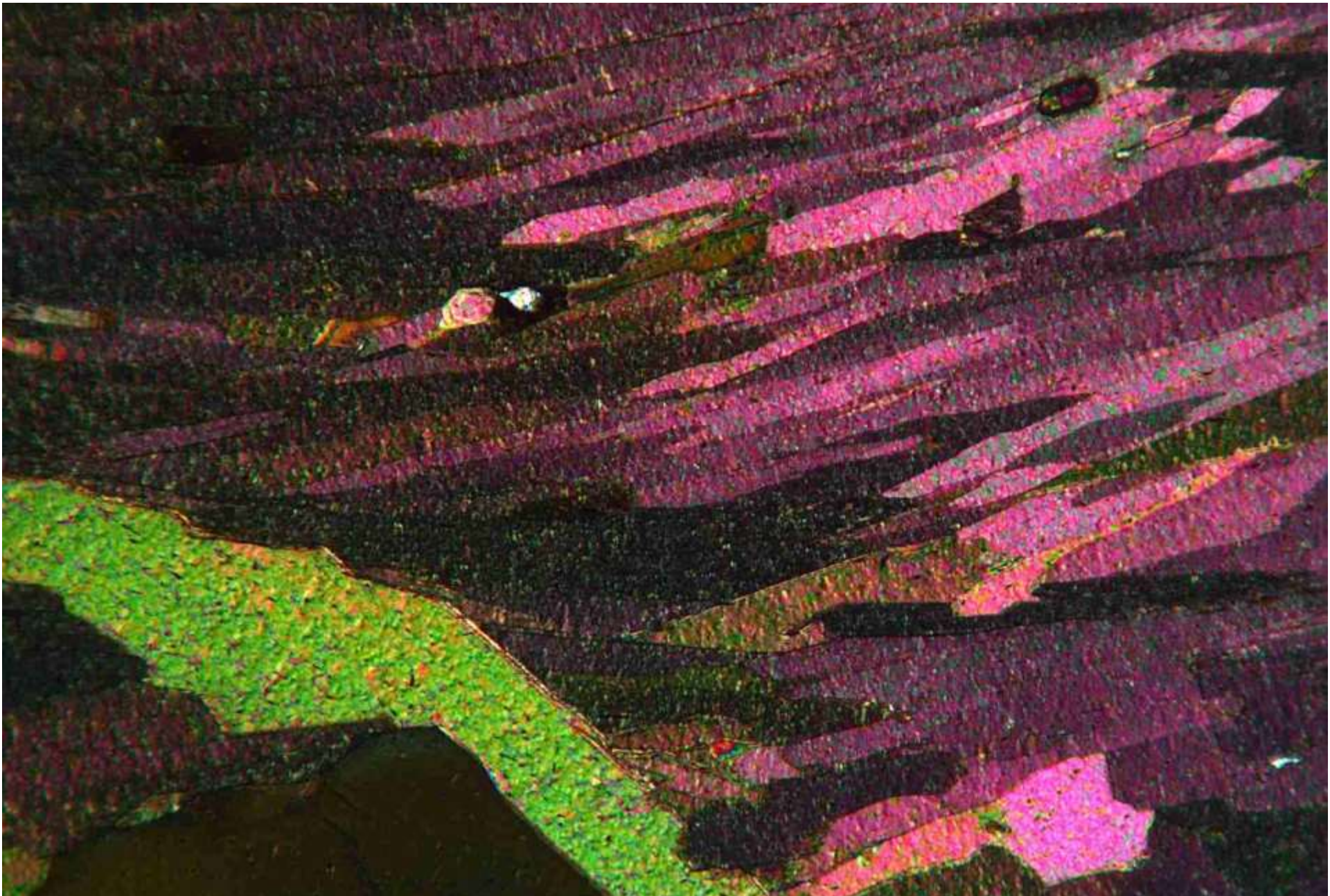


Biotite schist. Risseck Group, Austria.

ppl

MP

Same view under crossed polars



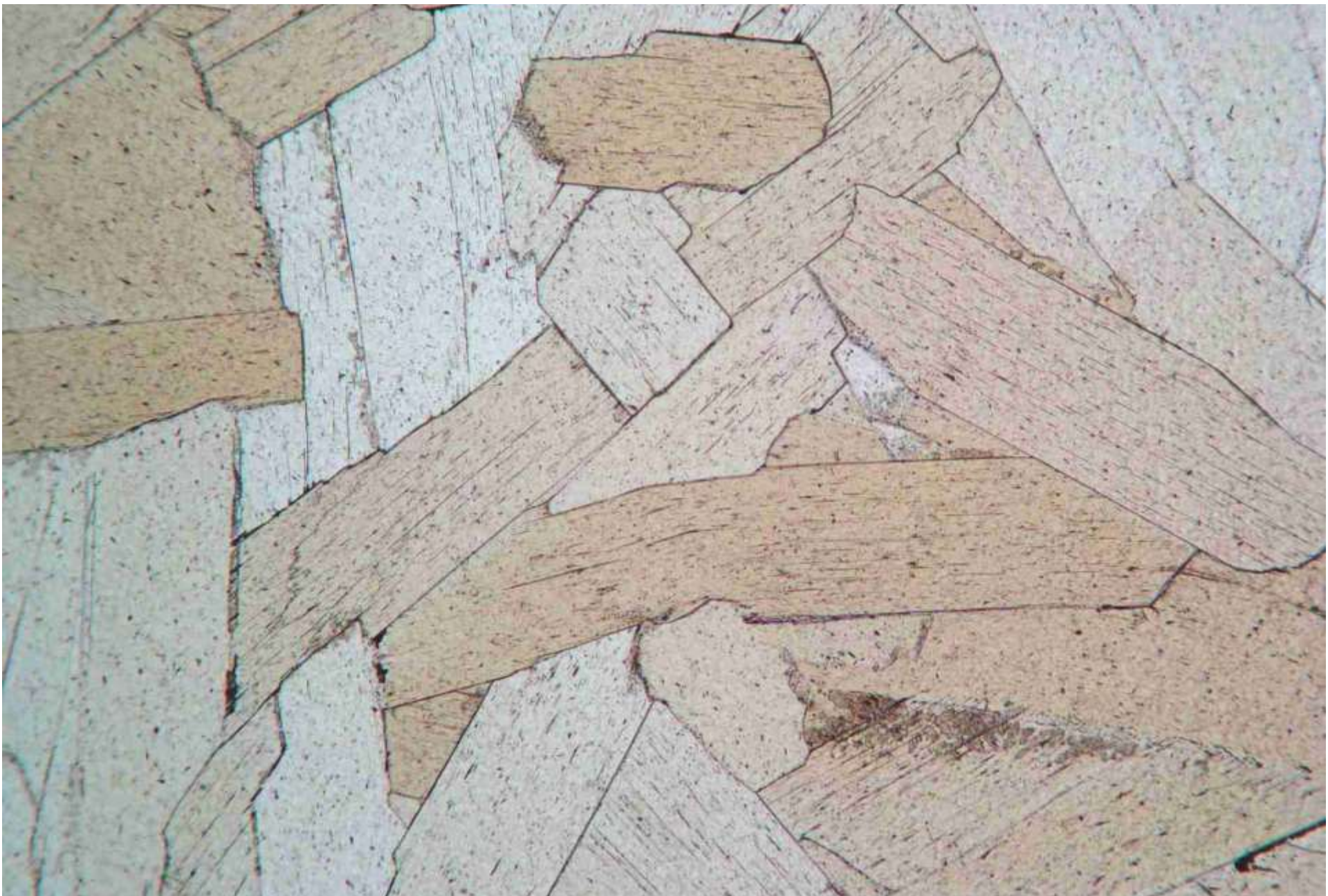
Biotite schist. Reisseck Group, Austria. xpol MP

Biotite with spinel (green) and plagioclase (colourless)



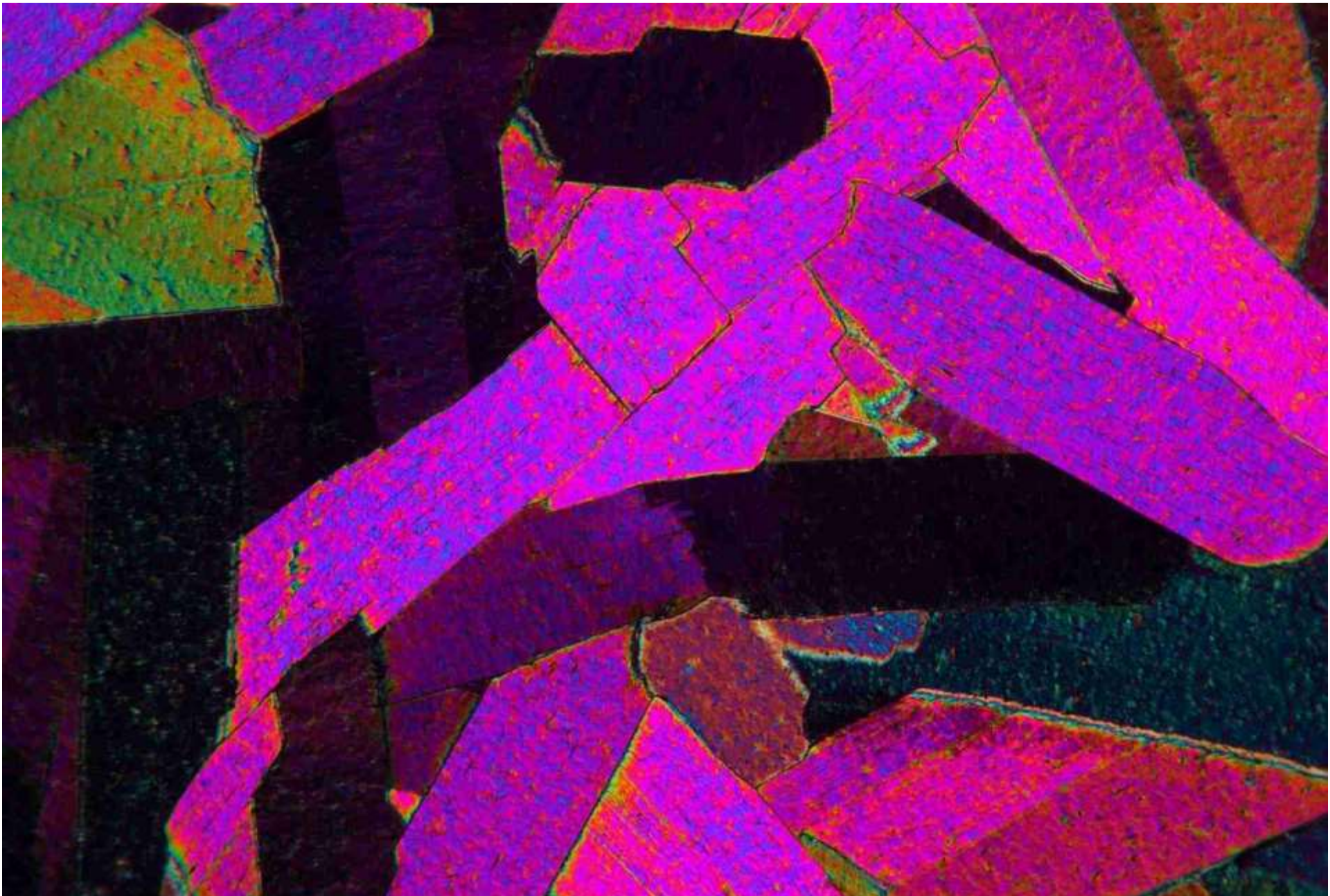
Corundum spinel biotite plagioclase granofels. Beitbridge, Zimbabwe. ppl MP

Biotite (var. phlogopite) with decussate texture



Corundum phlogopite granofels. Beitbridge, Zimbabwe. ppl MP

Same view under crossed polars



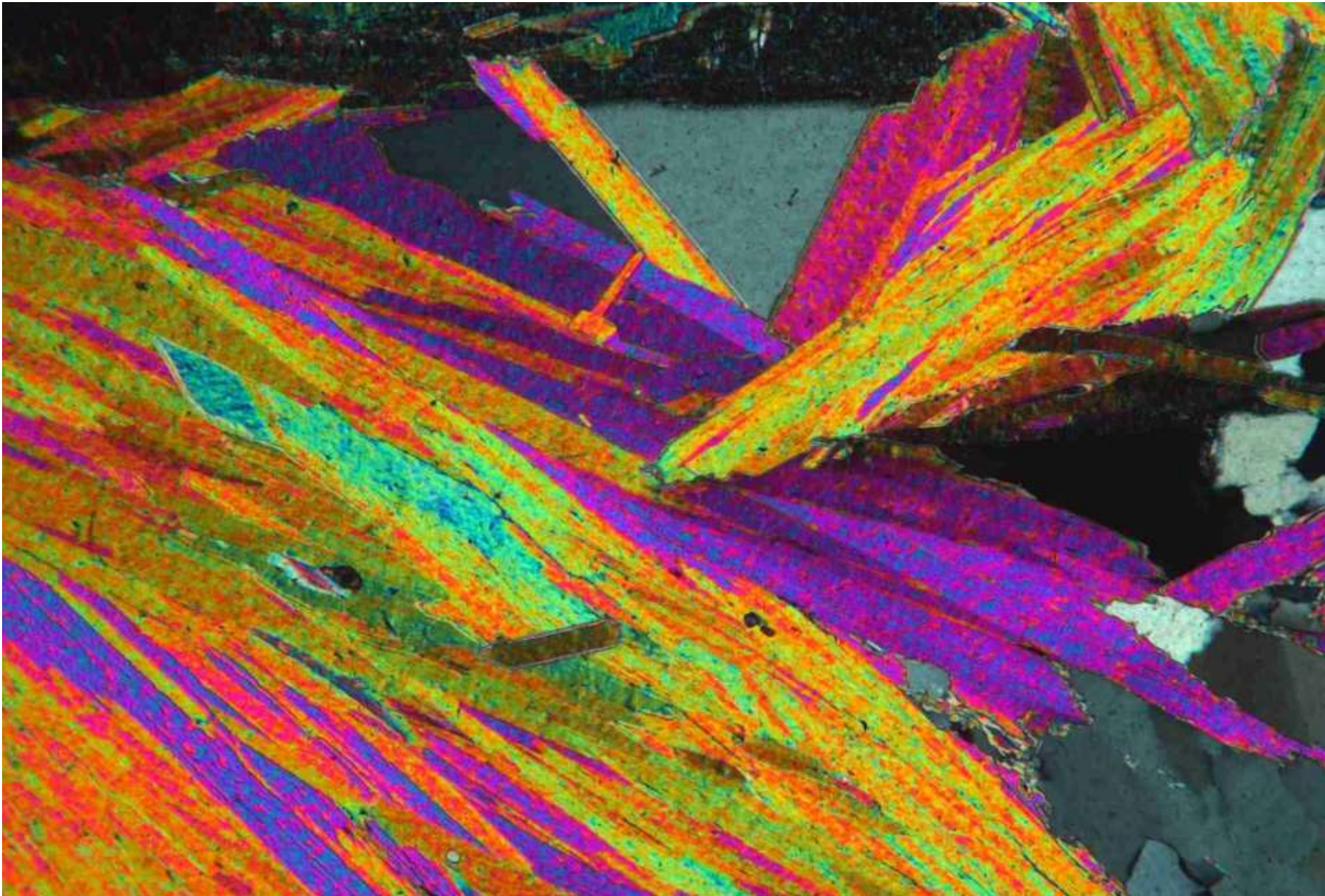
Corundum phlogopite granofels. Beitbridge, Zimbabwe. xpol MP

Biotite (brown) intergrown with muscovite and quartz



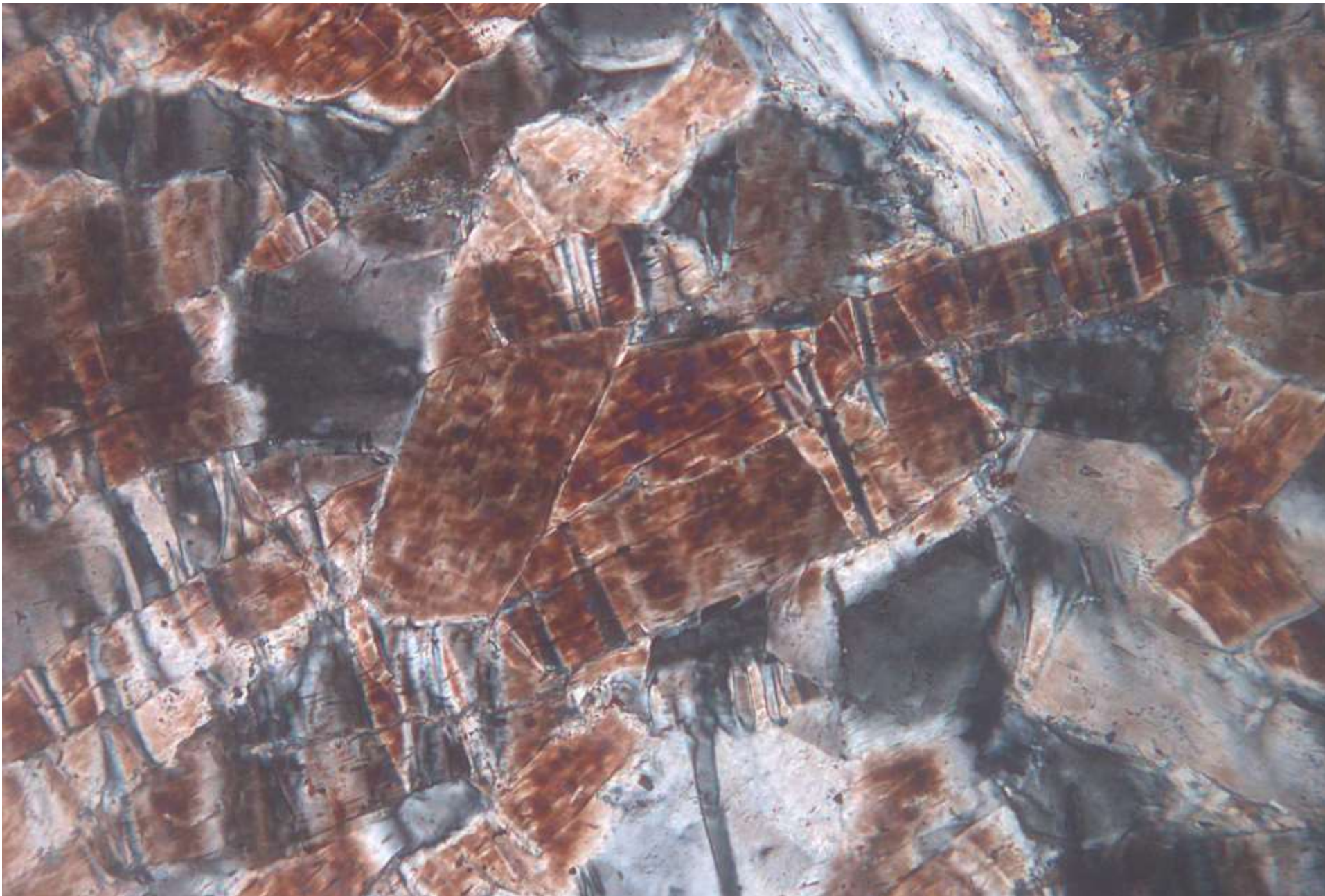
Mica schist. Reisseck Group, Austria. ppl MP

Same view under crossed polars



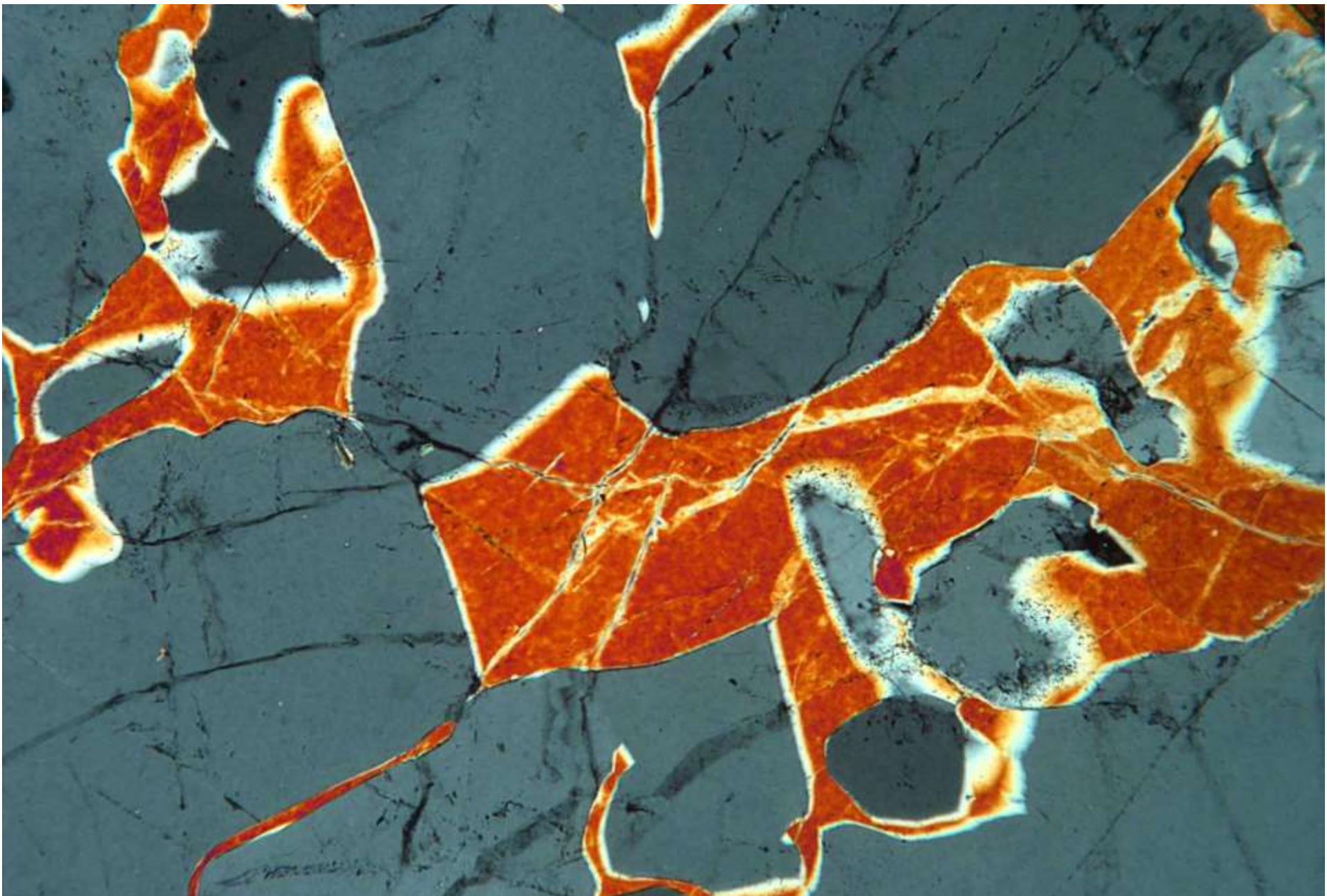
Mica schist. Reisseck Group, Austria. xpol MP

Aggregate of kinked brucite flakes



Brucite marble. Qadda, Saudi Arabia. xpol MP

Cancrinite (orange interference colour) replacing nepheline



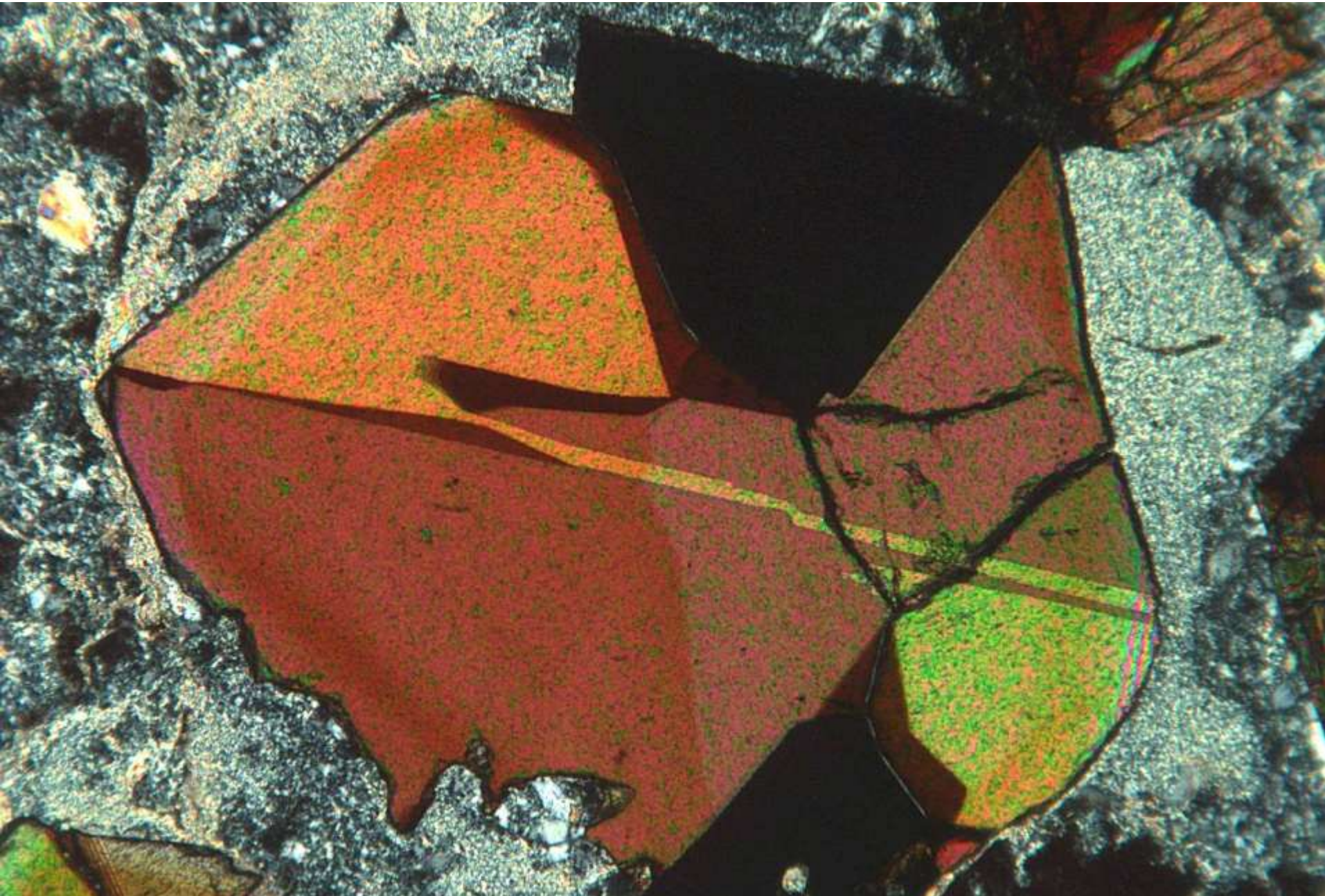
Nepheline syenite. Kirovsk, Kola Peninsula, Russia. xpol MP

Cassiterite crystal with zoning and cyclic twinning in a matrix of kaolinite and sericite



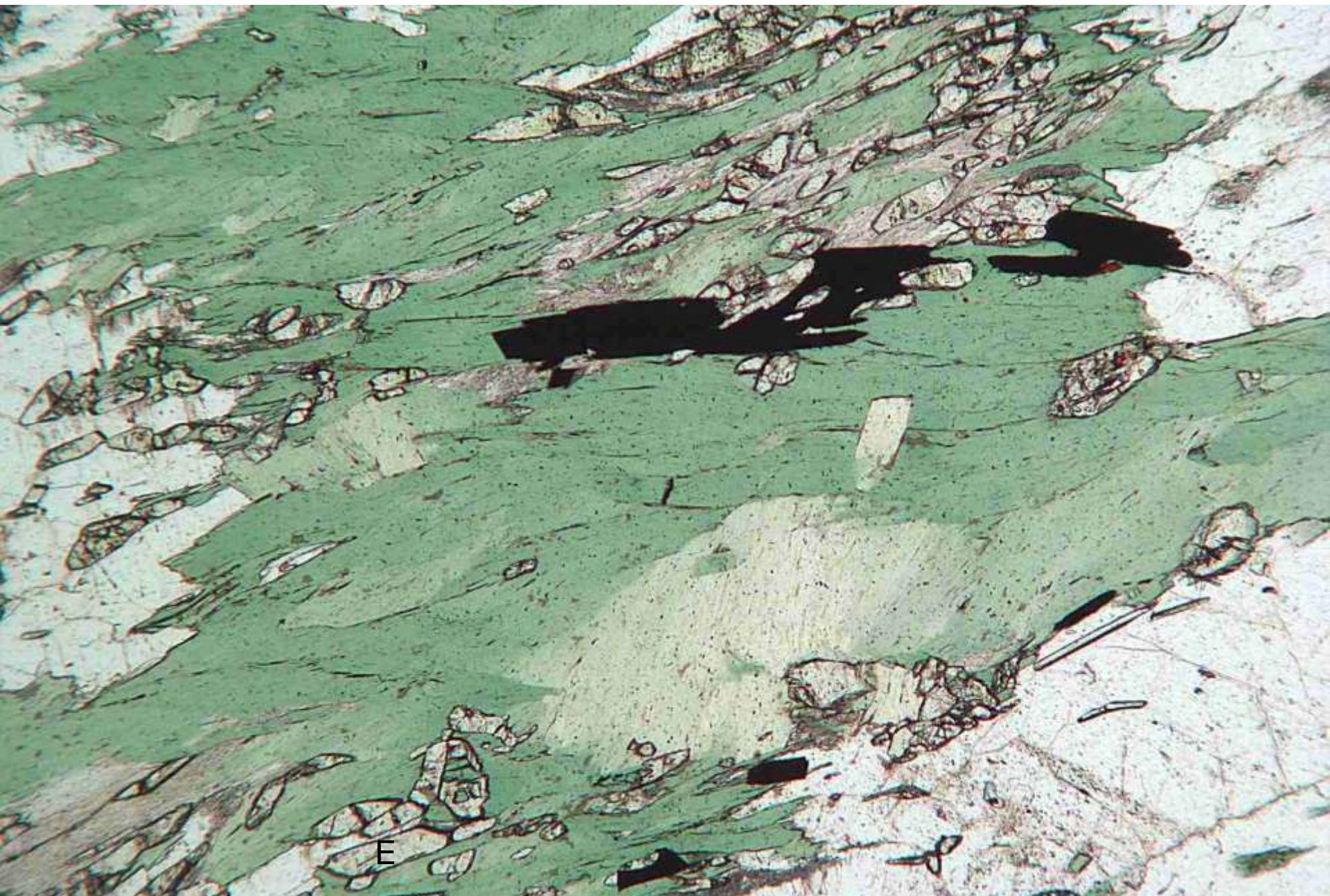
Vein rock. Zaaiplaats, Potgietersrus, South Africa. ppl MP

Same view under crossed polars



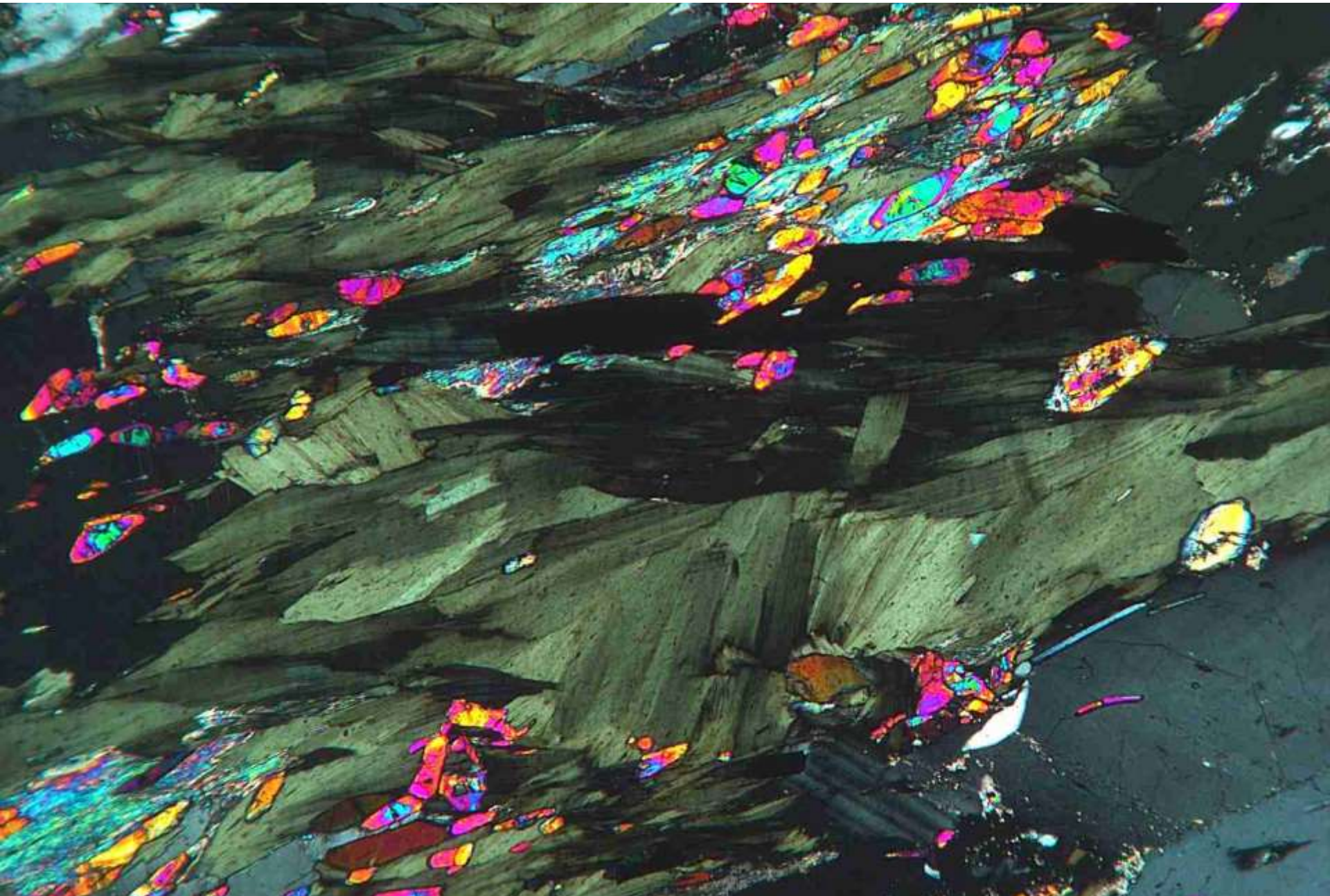
Vein rock. Zaaiplaats, Potgietersrus, South Africa. xpol MP

Chlorite (green) with albite (colourless), epidote, muscovite and opaques



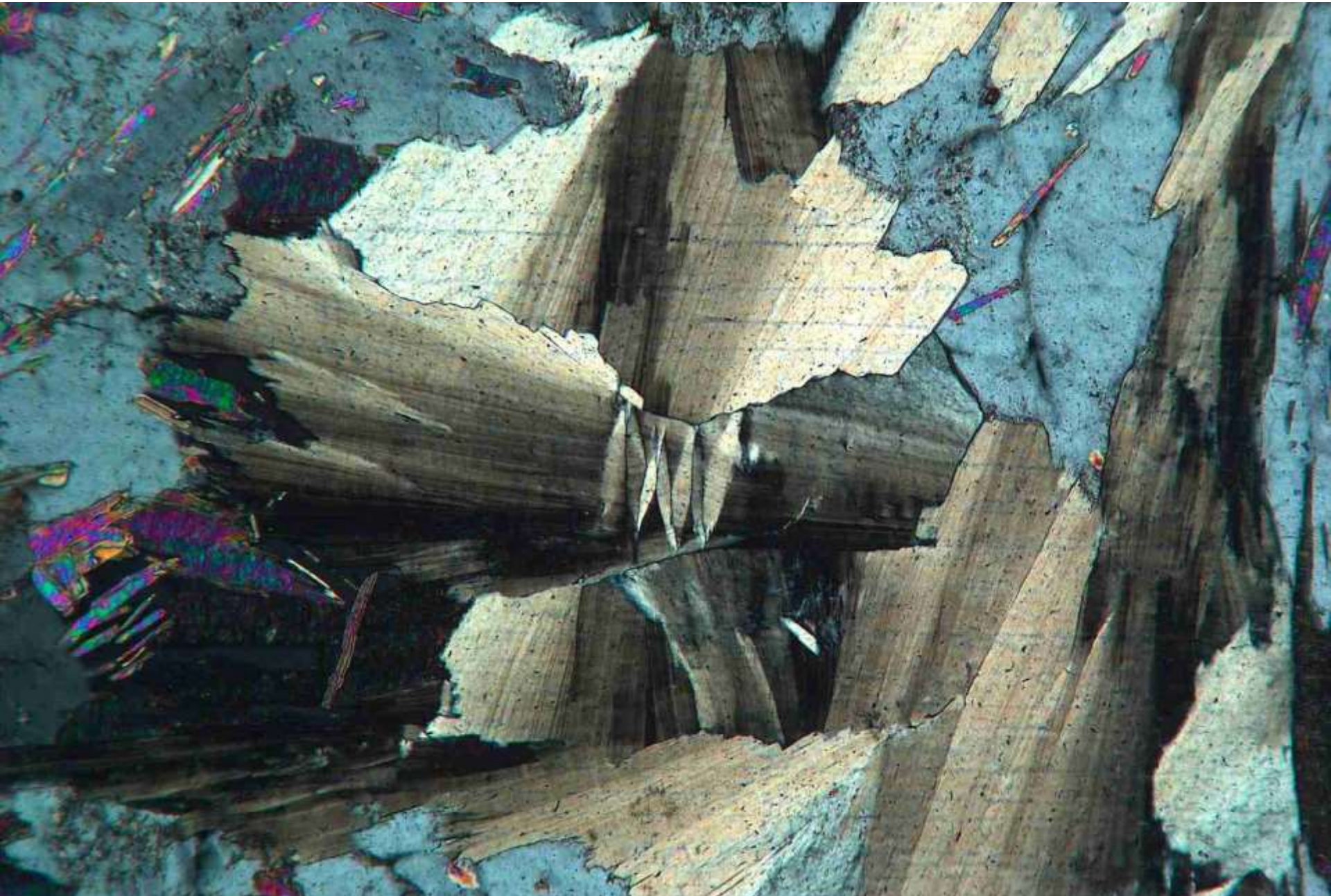
Epidote albite chlorite schist. Döllach, Austria. ppl MP

Same view under crossed polars



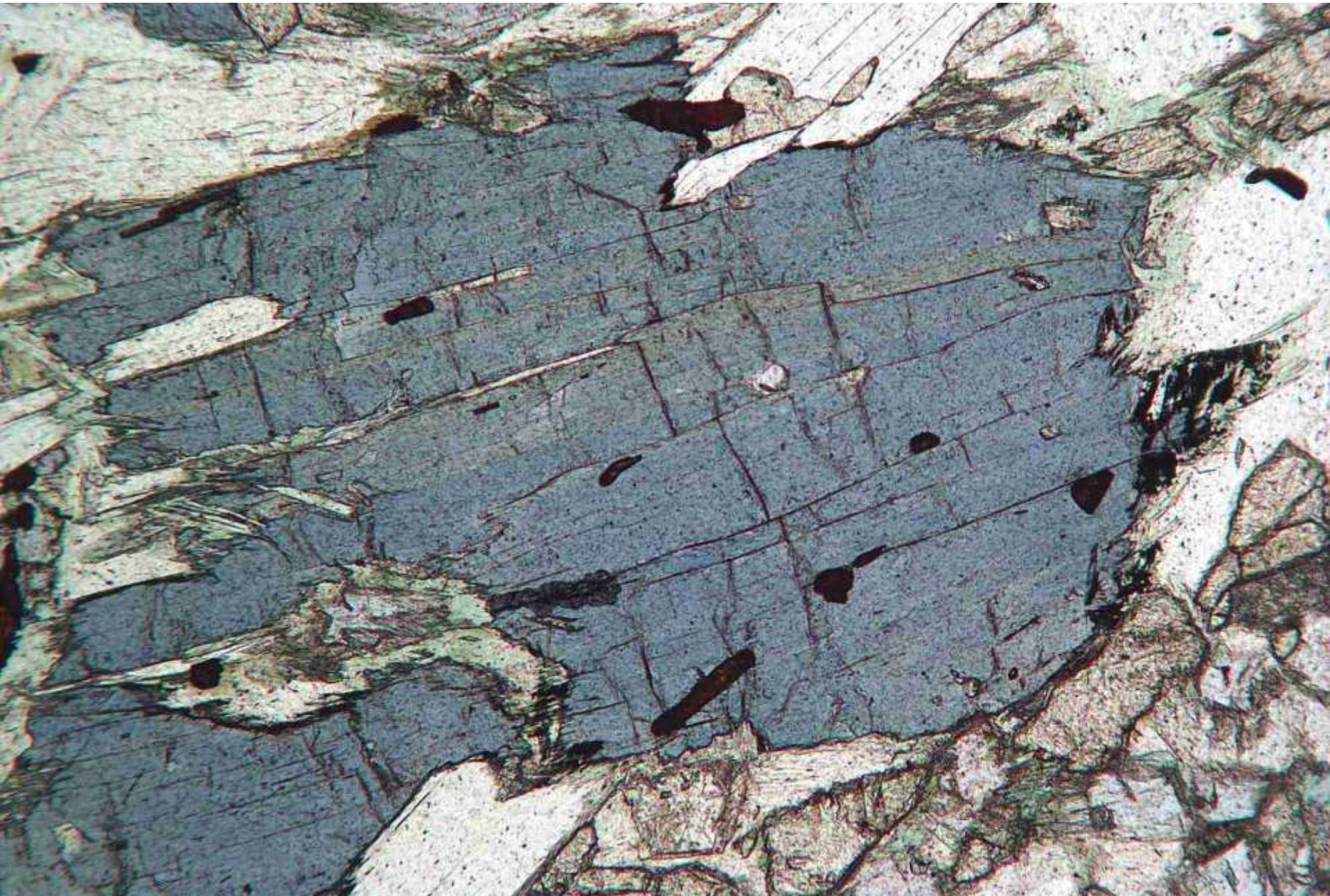
Epidote albite chlorite schist. Döllach, Austria. xpol MP

Chlorite (var. clinochlore) with plagioclase (grey interference colour) and muscovite



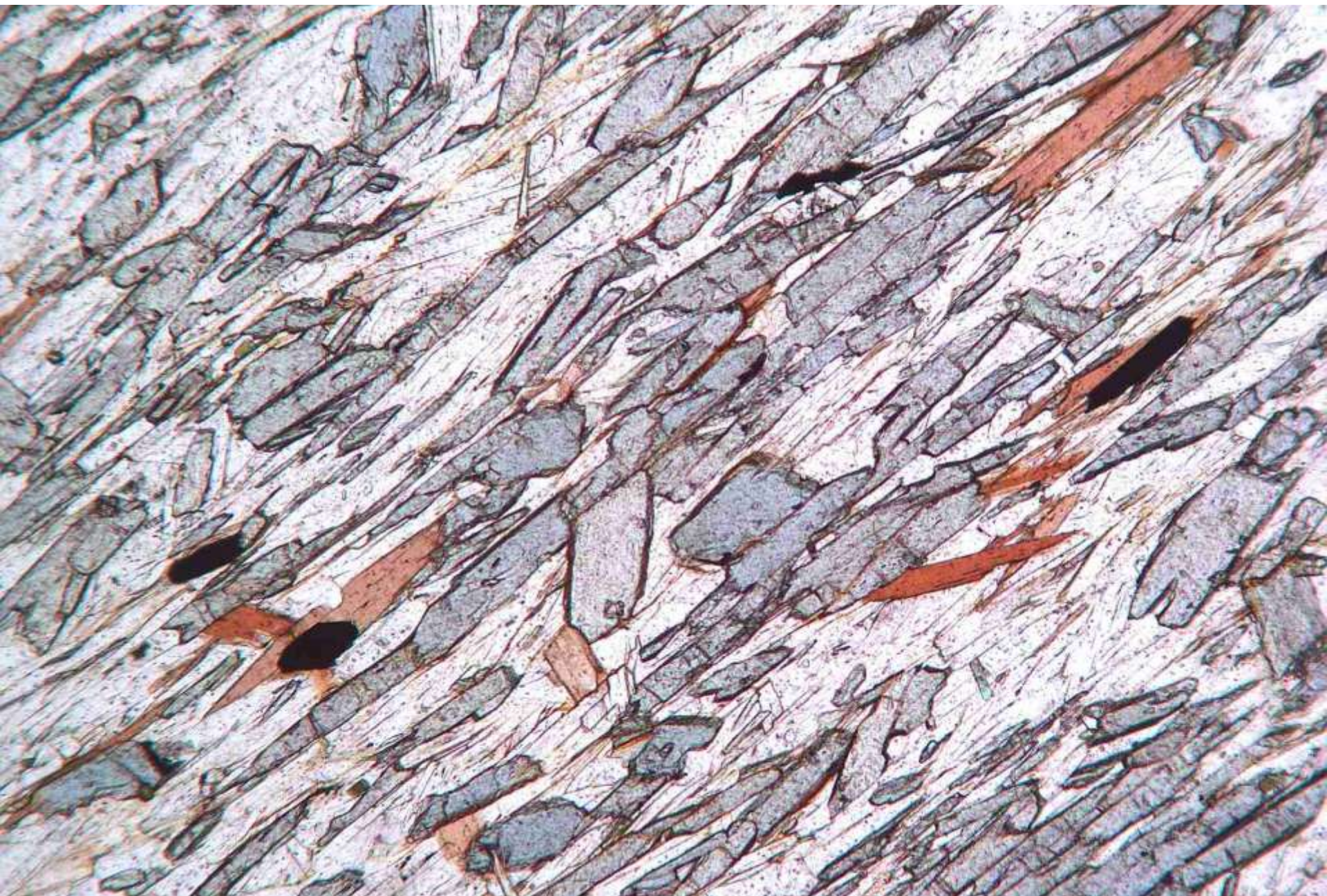
Kyanite chlorite mica schist. Reisseck Group, Austria. xpol MP

Chloritoid (blue) with micas, talc, epidote etc



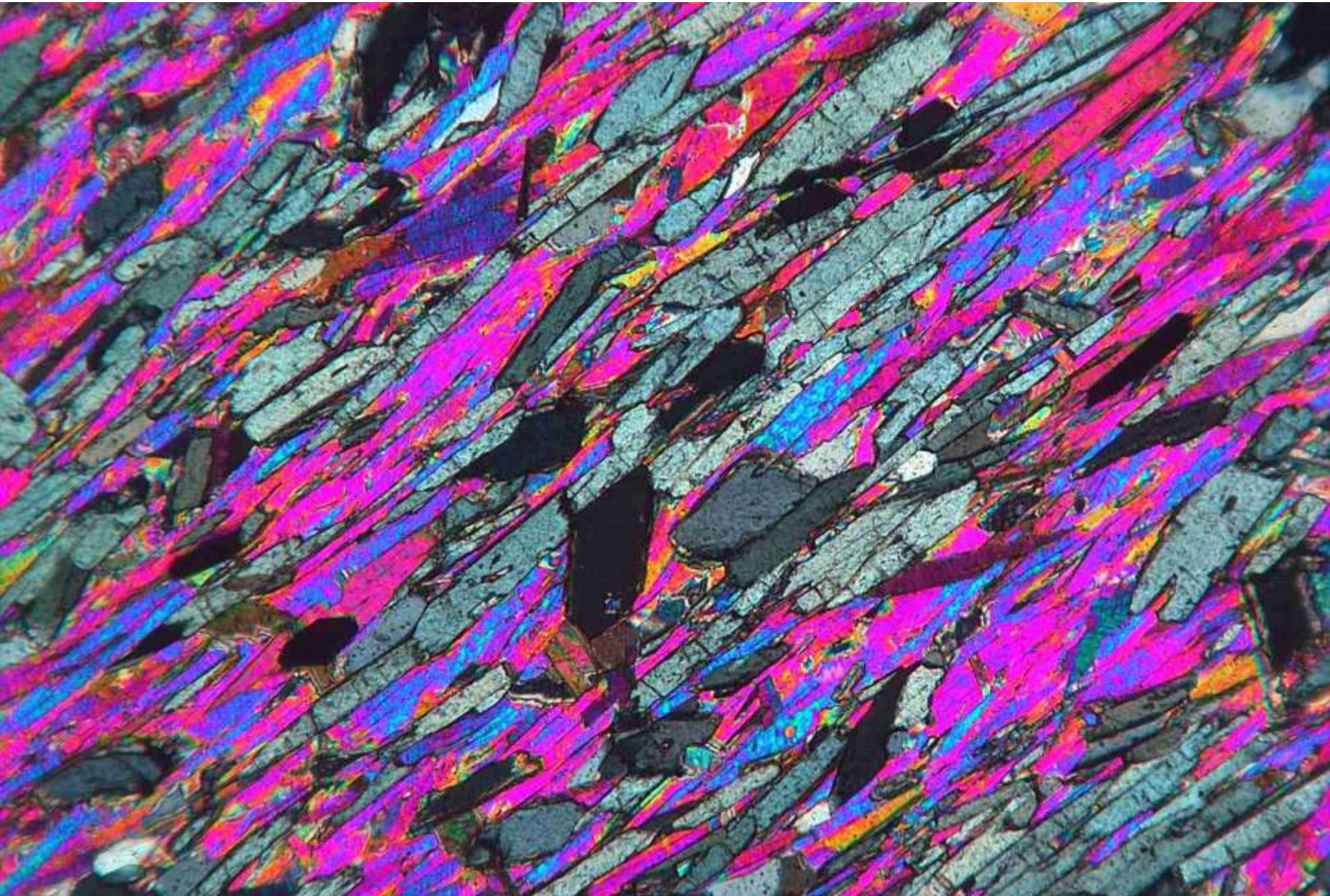
Chloritoid talc epidote glaucophane schist. Täschalm, Switzerland. ppl MP

Chloritoid (blue) with muscovite (colourless), biotite (brown) and opaques



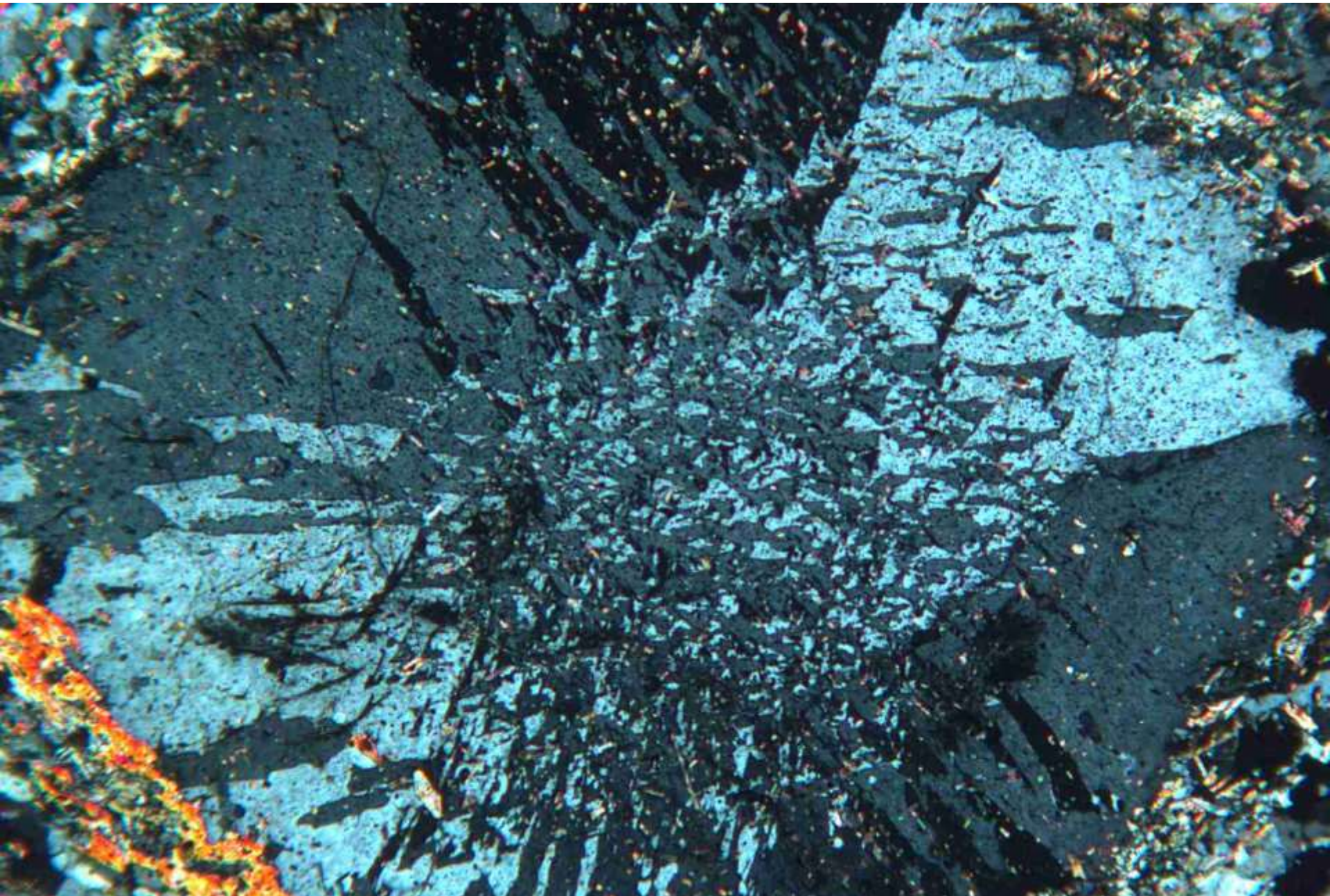
Chloritoid mica schist. Dösener Tal, Mallnitz, Austria. ppl MP

Same view under crossed polars



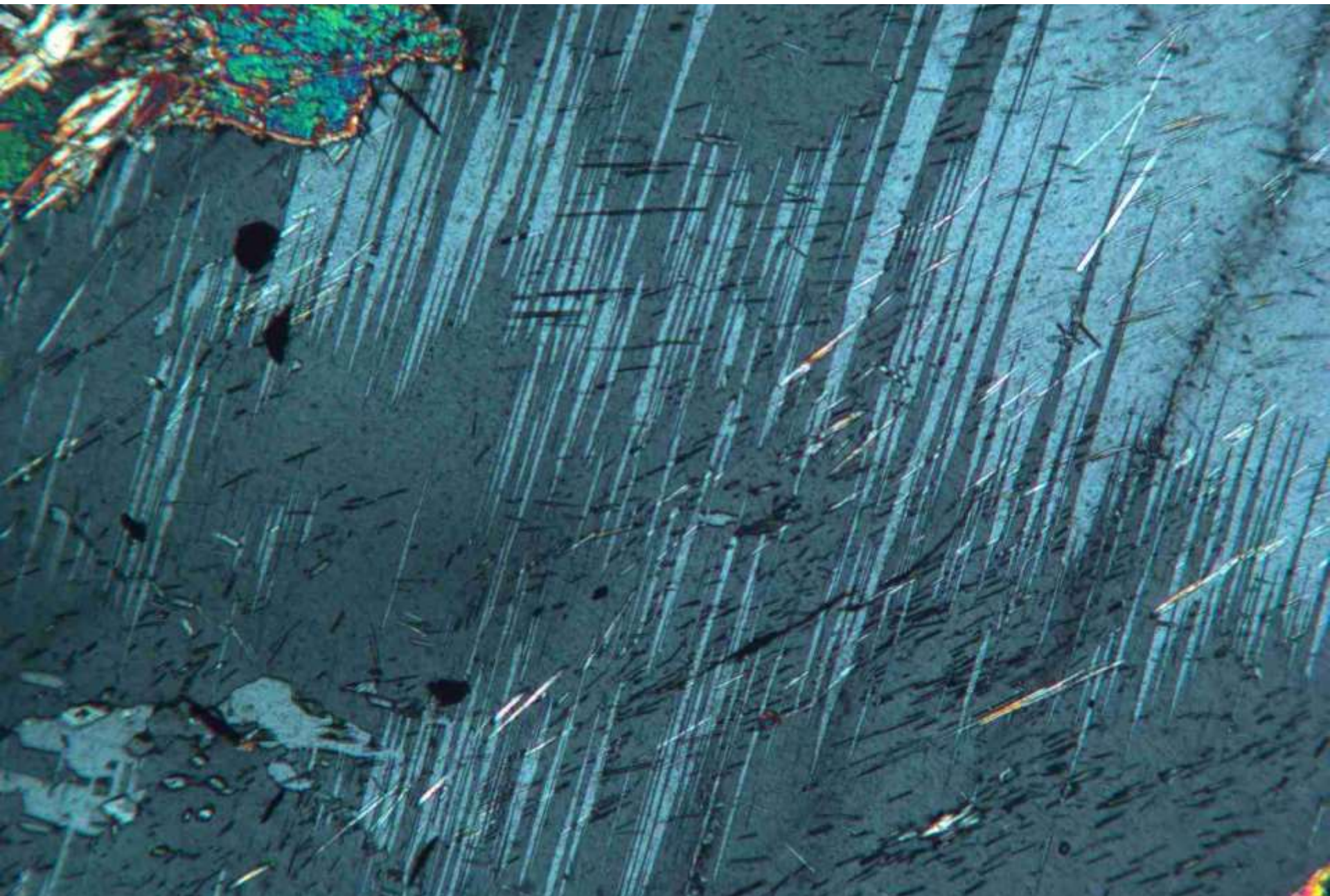
Garnet chloritoid mica schist. Dösener Tal, Mallnitz, Austria. xpol MP

Cordierite with sector twinning



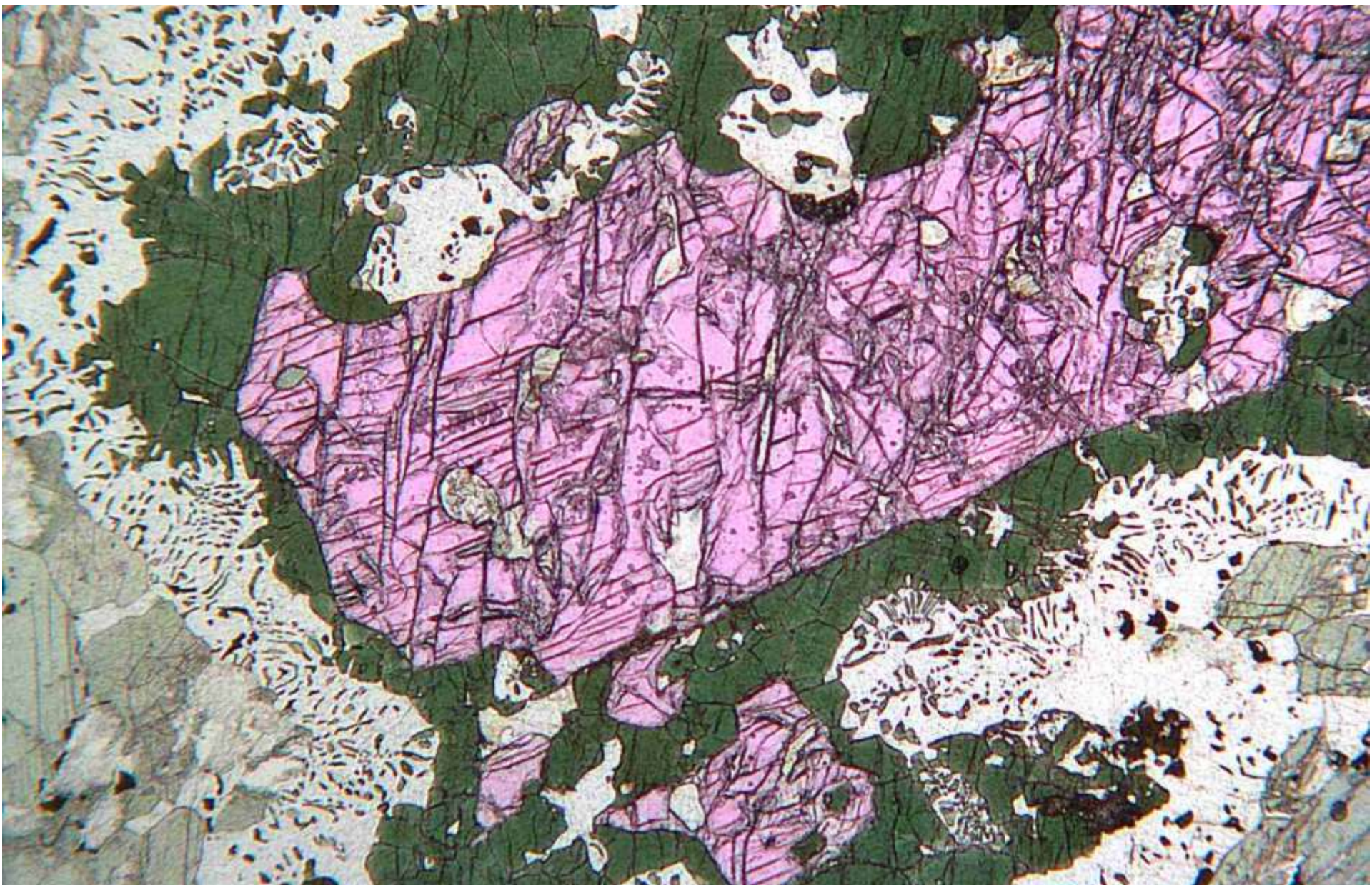
Garnet cordierite hornfels. Cuttlehill, Scotland. xpol MP

Cordierite with multiple twinning and sillimanite inclusions



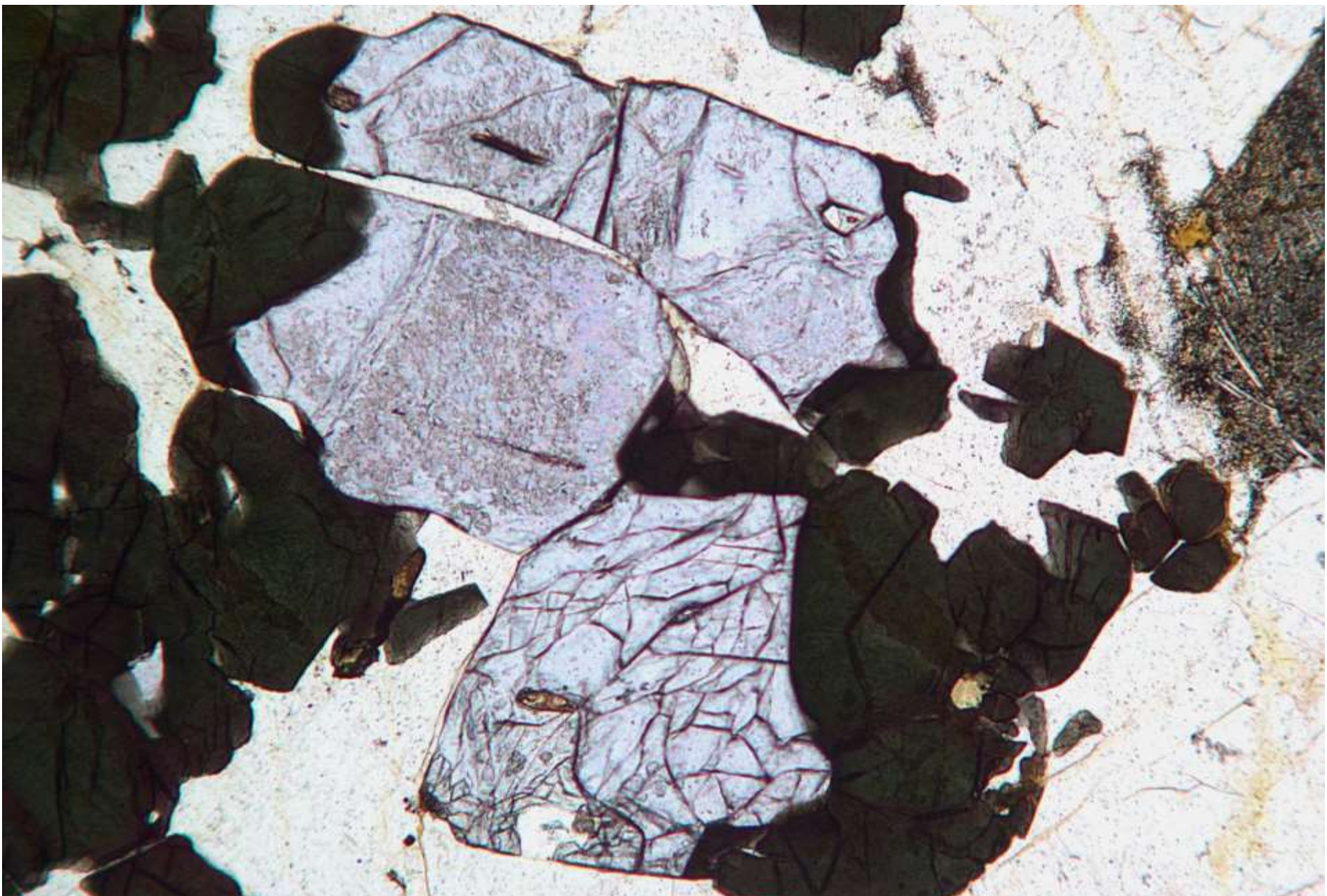
Garnet cordierite sillimanite gneiss. Massachusetts, USA. xpol MP

Corundum (var. ruby) with spinel (dark green), plagioclase (colourless) and hornblende (pale green)



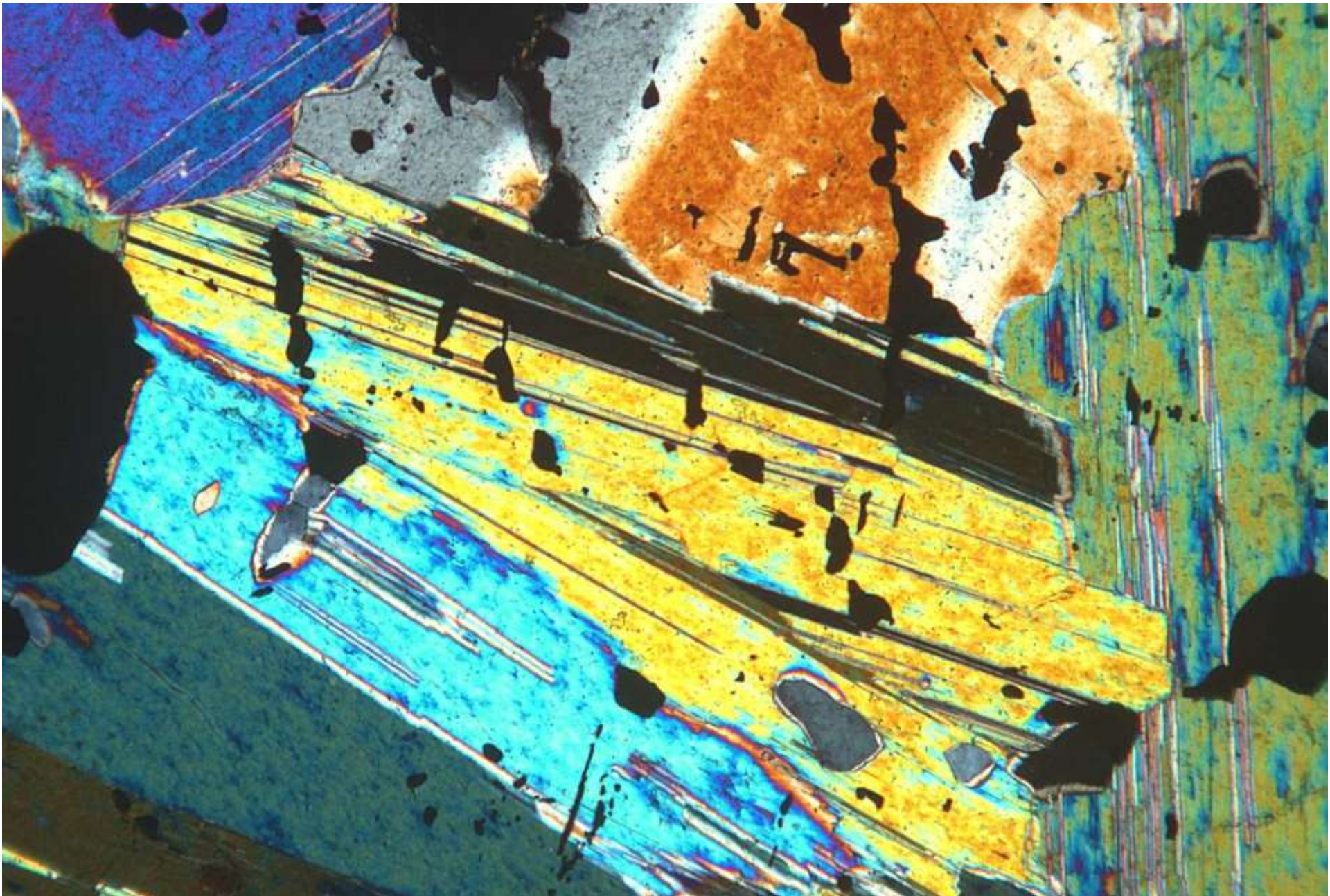
Corundum hornblende granofels. Kodaikanal, S India. ppl LP

Corundum (var. sapphire) with spinel (dark) and plagioclase



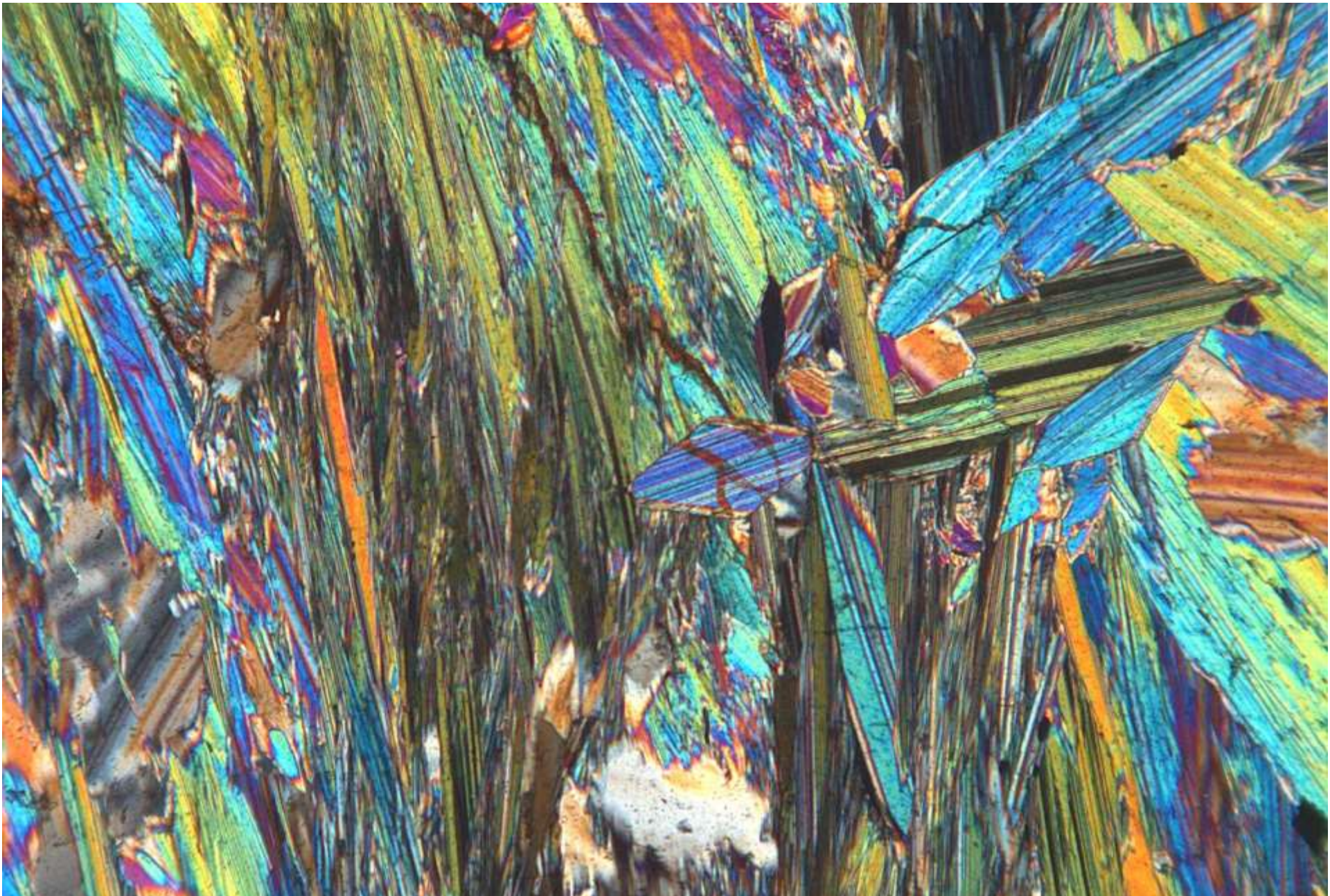
Buchite (xenolith in dolerite sill). Rudh' a Chromain, Mull, Scotland. ppl MP

Grunerite with multiple twinning



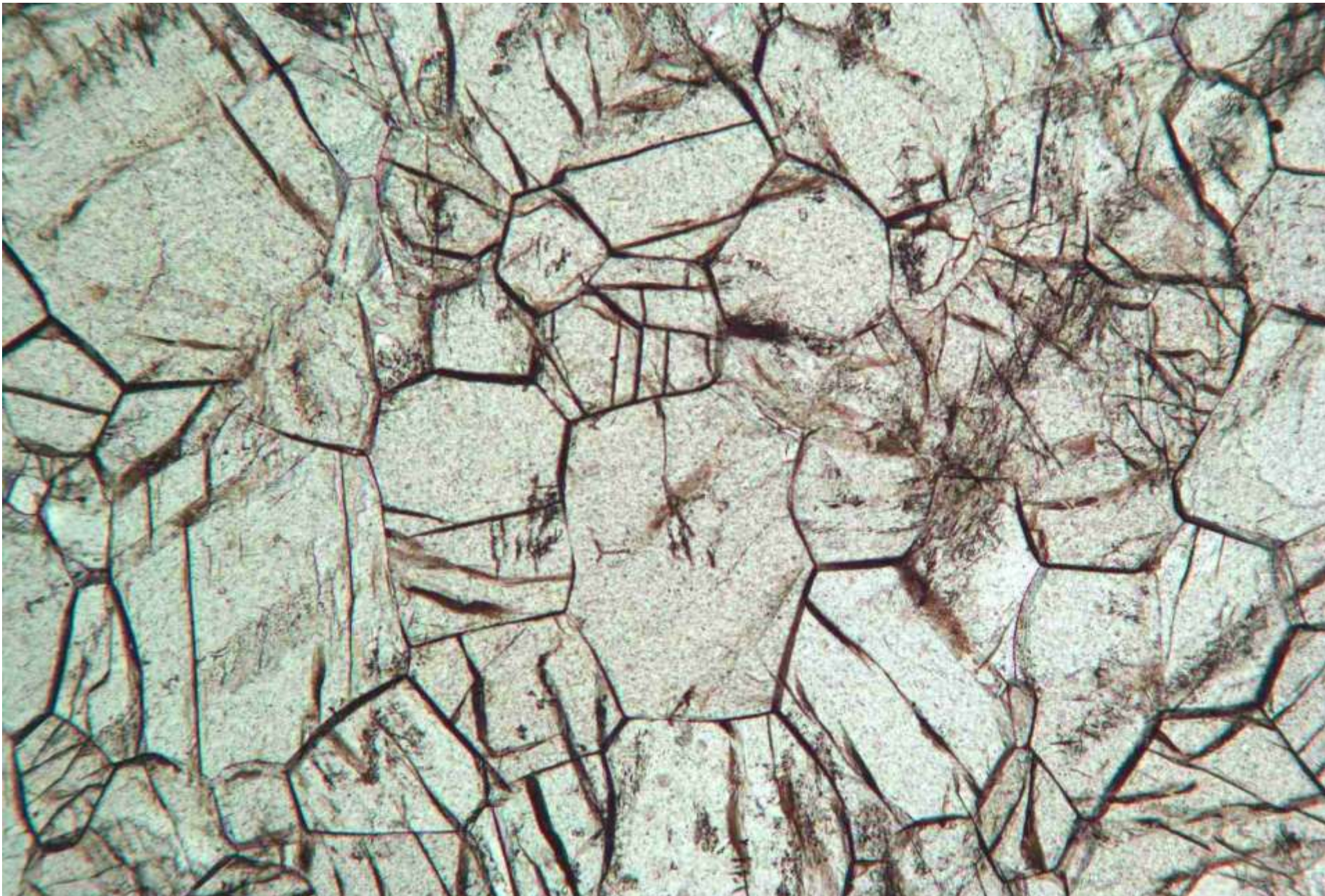
Garnet grunerite rock. Glenelg, Scotland. xpol MP

Grunerite with multiple twinning



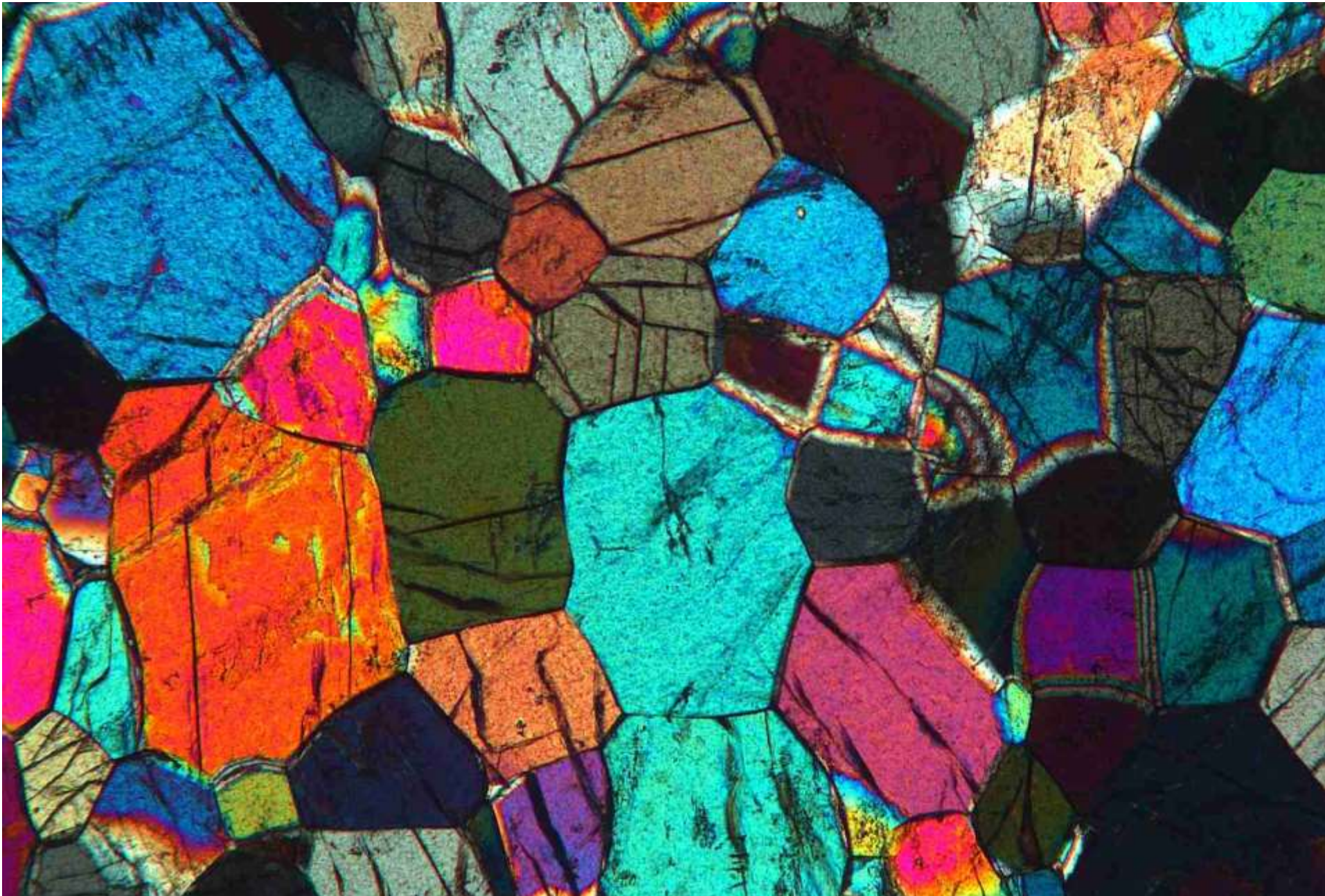
Garnet grunerite schist. Collobrières, S France. xpol MP

Diopside with granoblastic polygonal texture



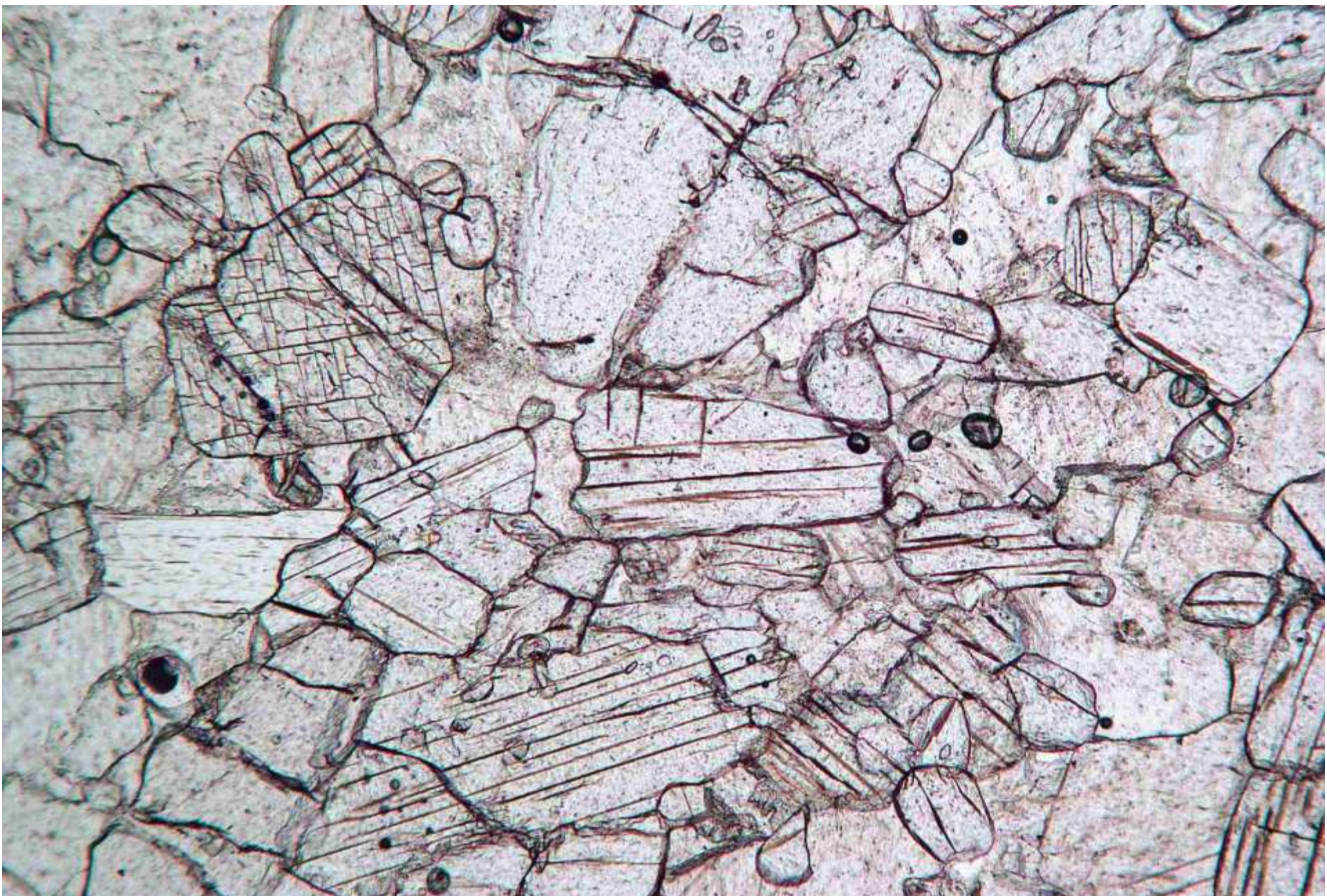
Diopside hornfels. Auchedly, Scotland. ppl MP

Same view under crossed polars



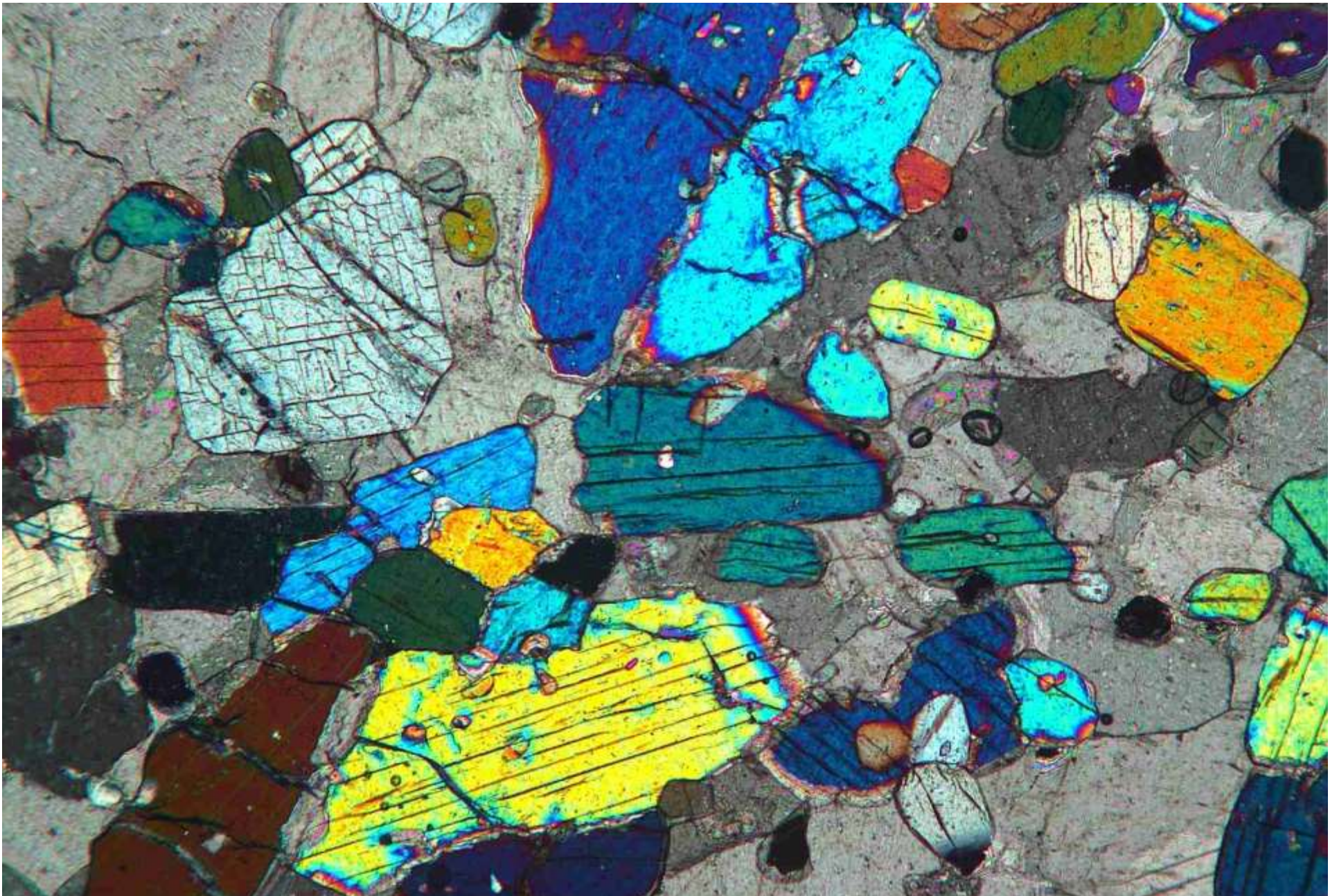
Diopside hornfels. Auchedly, Scotland. xpol MP

Diopside (showing cleavage) in calcite



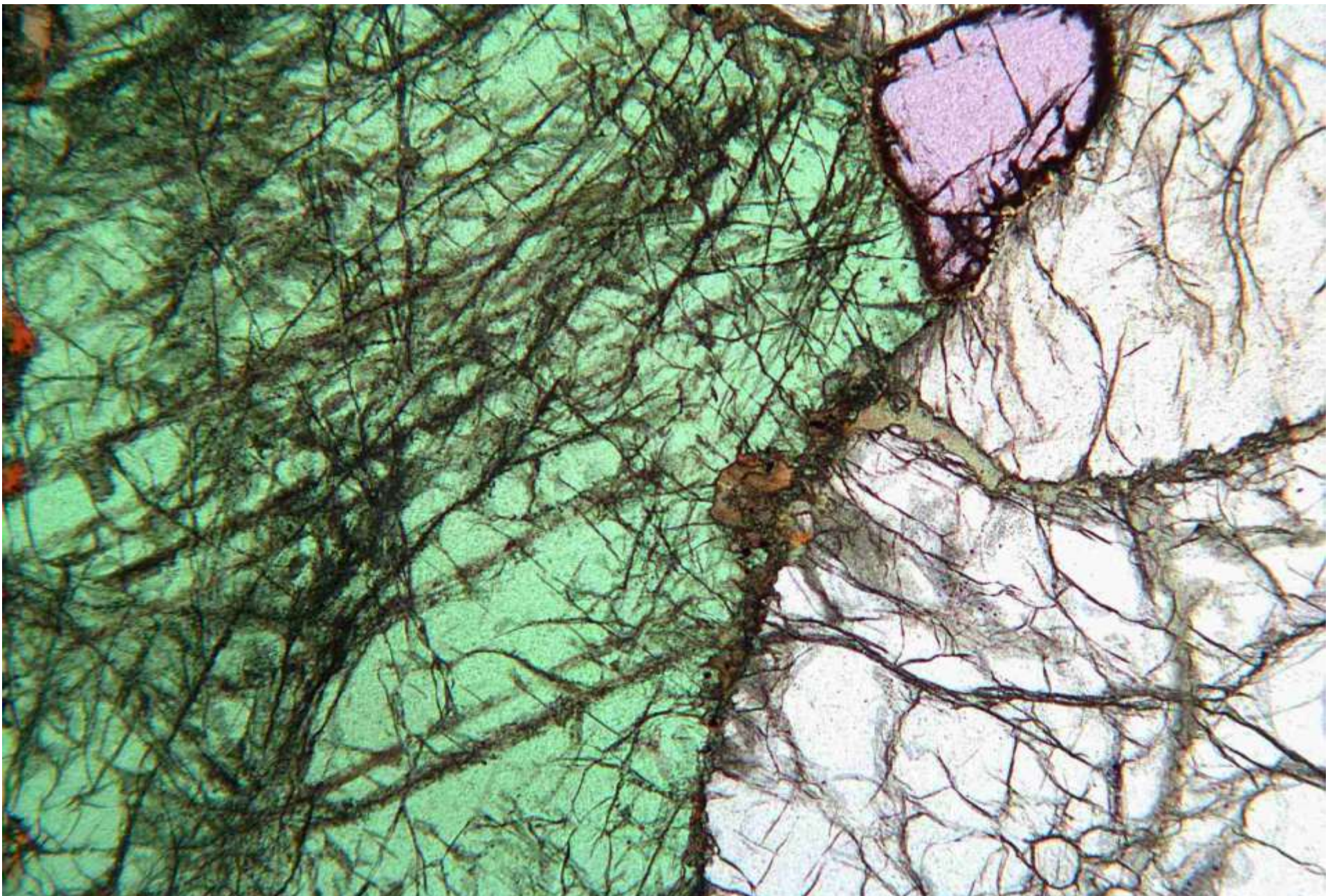
Diopside marble. Glen Dessary, Scotland. ppl MP

Same view under crossed polars



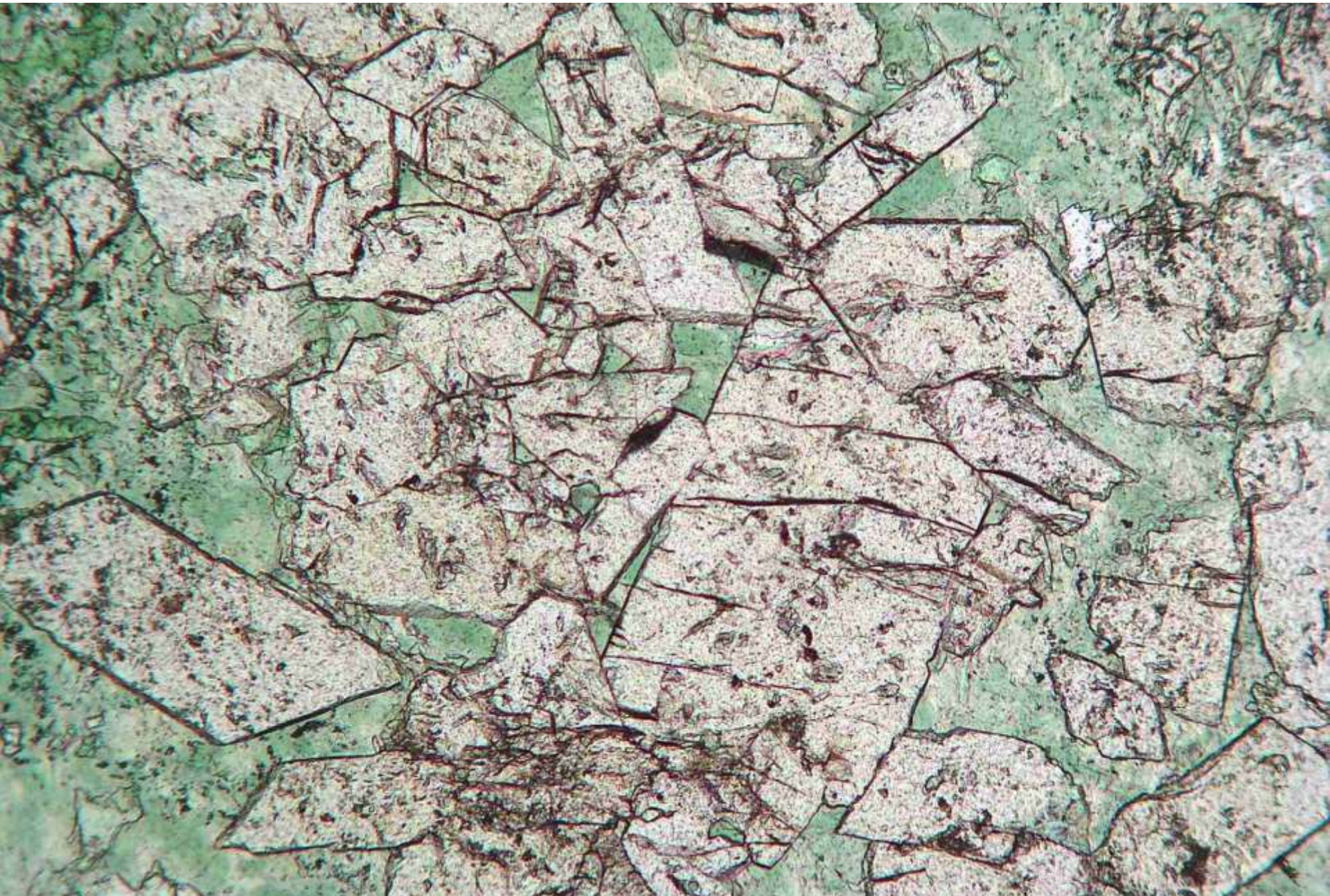
Diopside marble. Glen Dessary, Scotland. xpol MP

Chrome-diopside (green) with olivine (colourless) and pyrope garnet (pink)



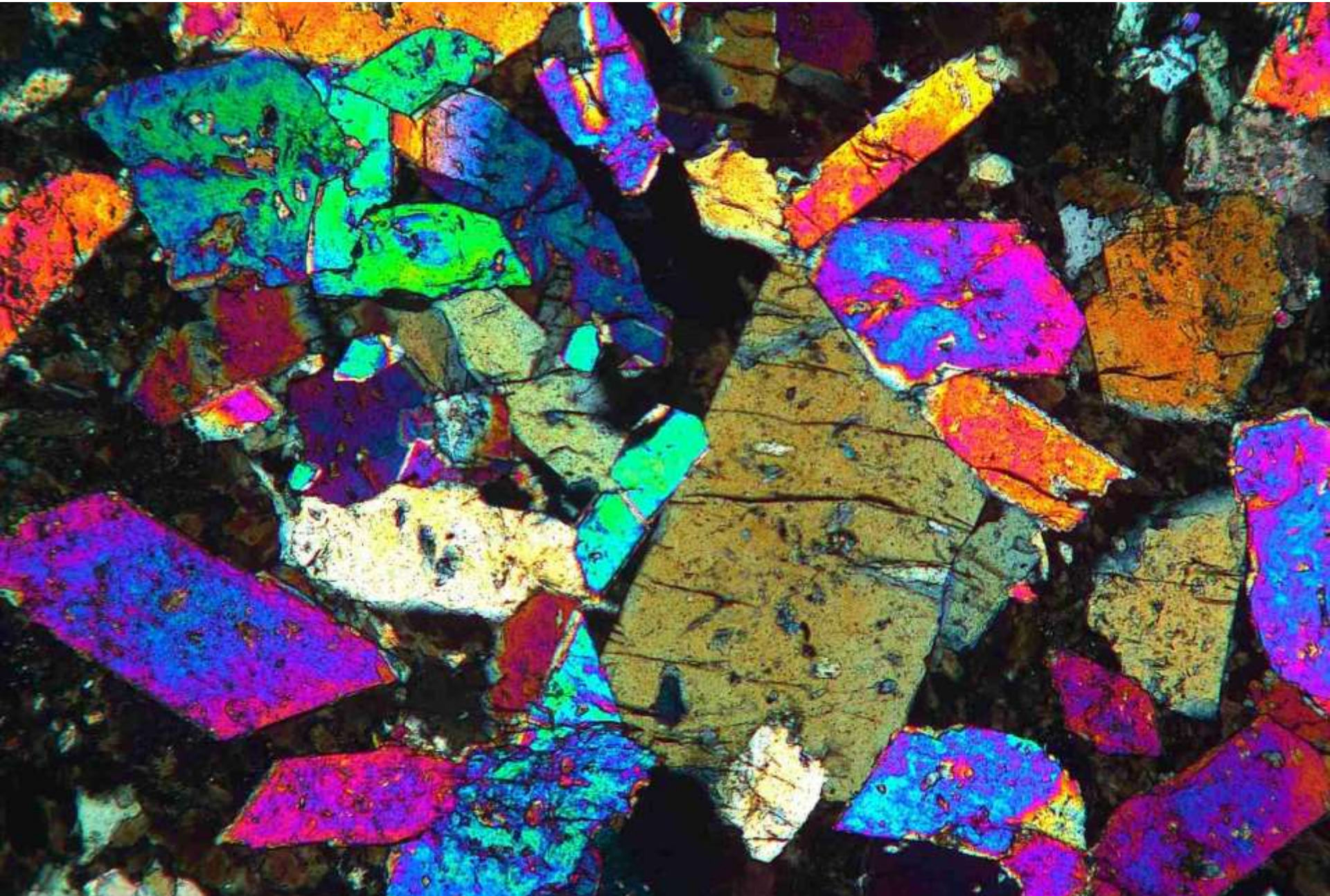
Garnet lherzolite. Bultfontein, South Africa. ppl LP

Epidote (pale) with chlorite (green)



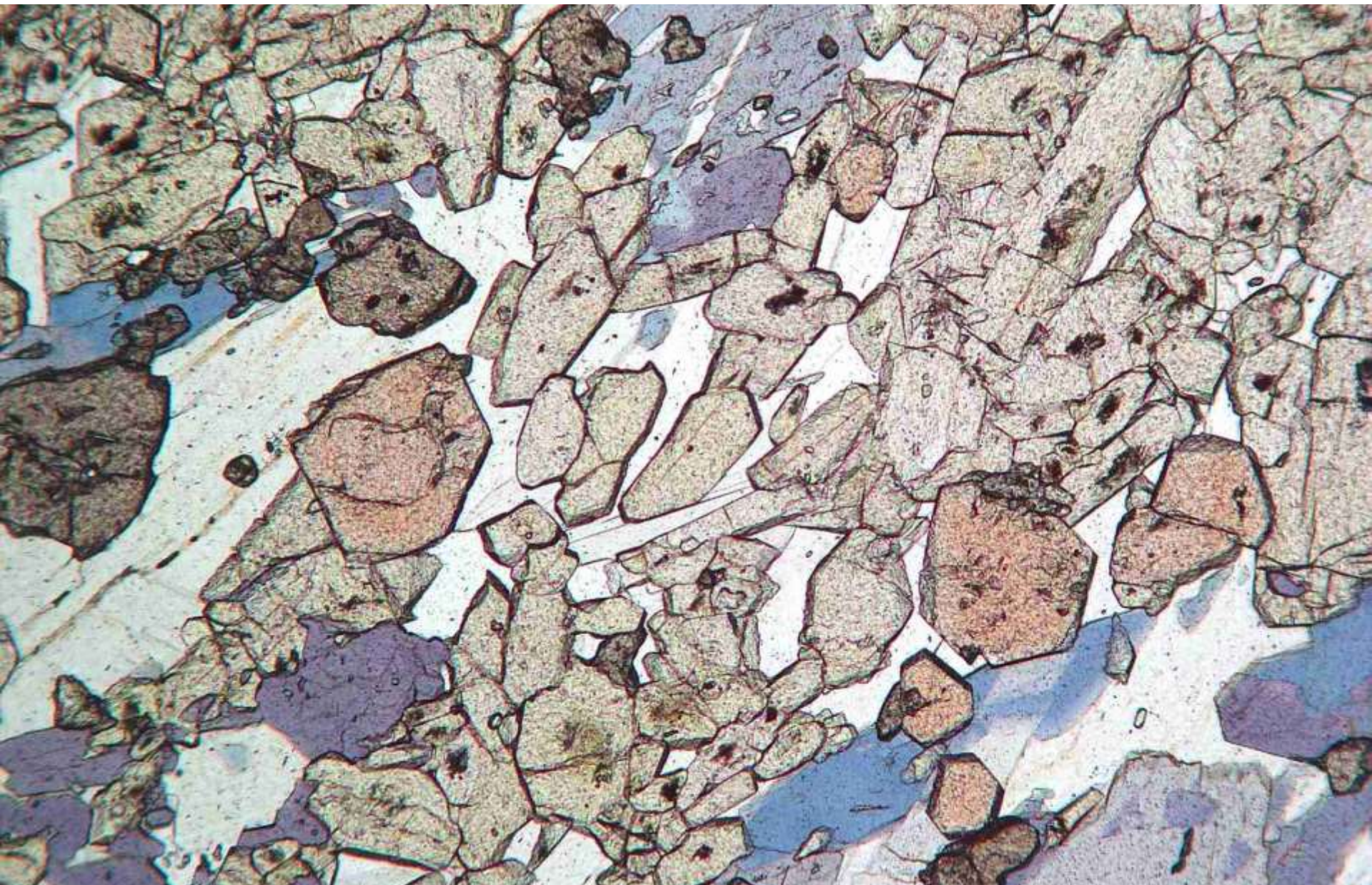
Epidote chlorite granofels. Altınekin, Konya, Turkey. ppl MP

Same view under crossed polars



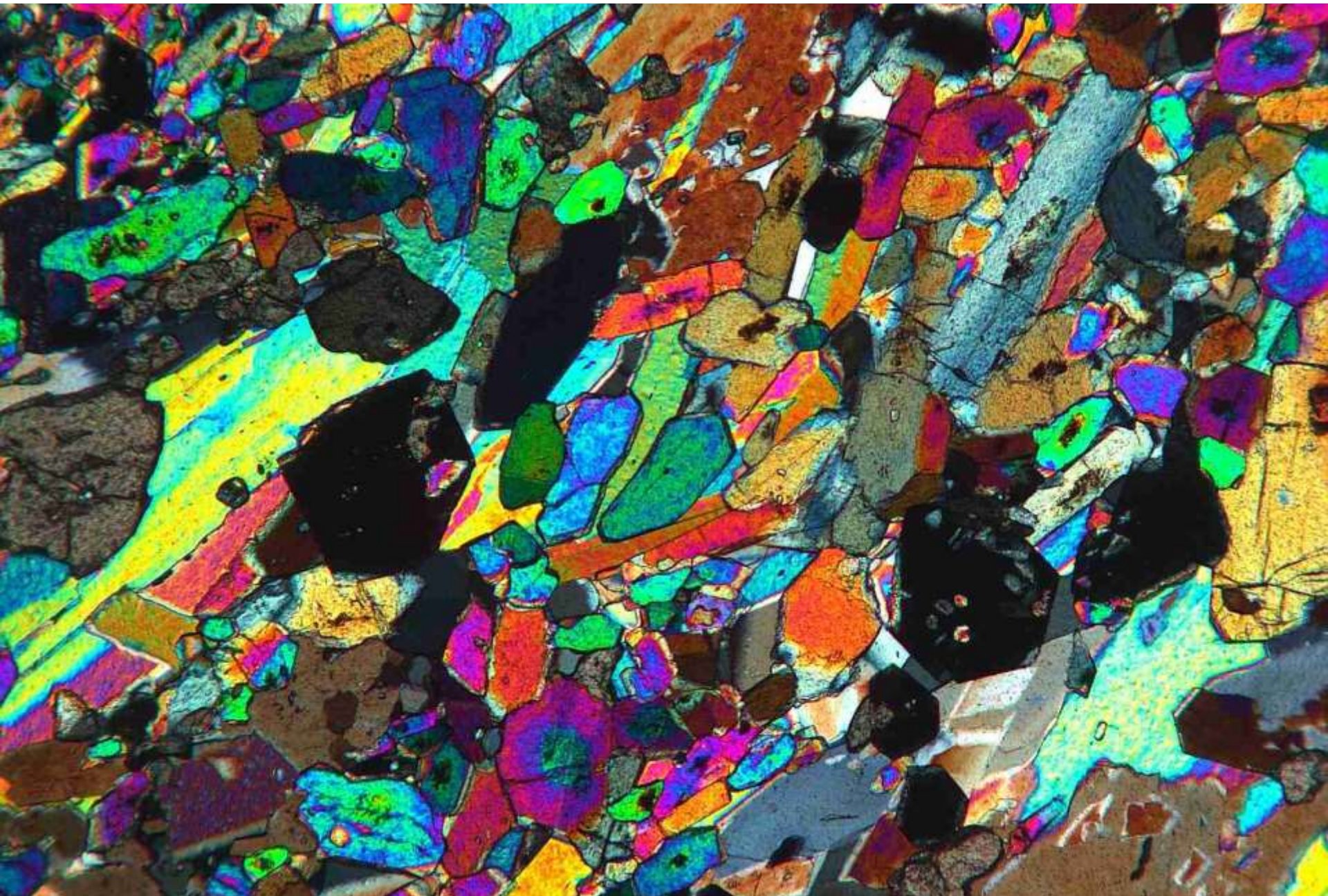
Epidote chlorite granofels. Altinekin, Konya, Turkey. xpol MP

Epidote (pale yellow) with garnet (pink), white mica, quartz, glaucophane (blue) and sphene (brown)



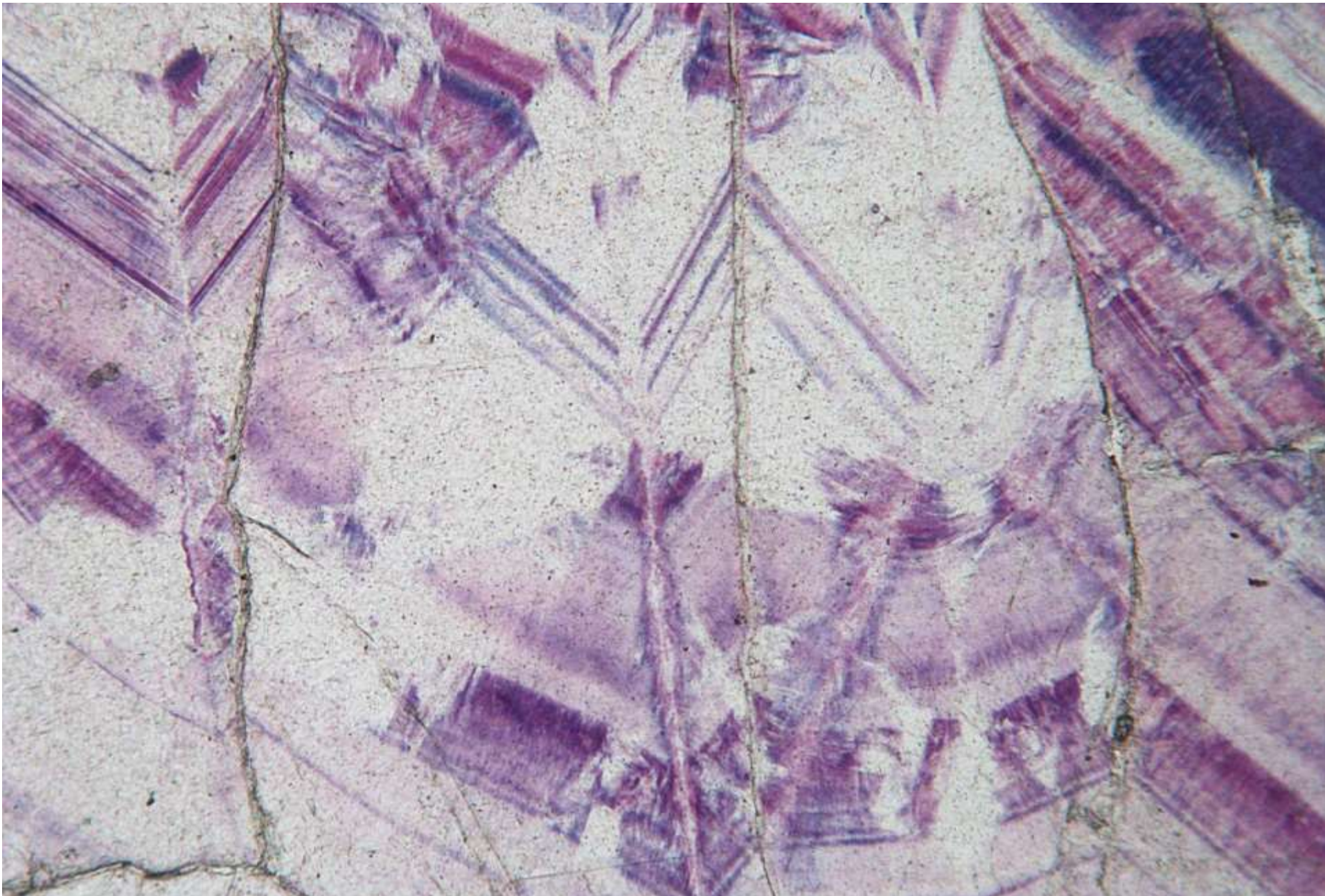
Garnet epidote glaucophane schist. Ward Creek, California, USA. ppl MP

Same view under crossed polars



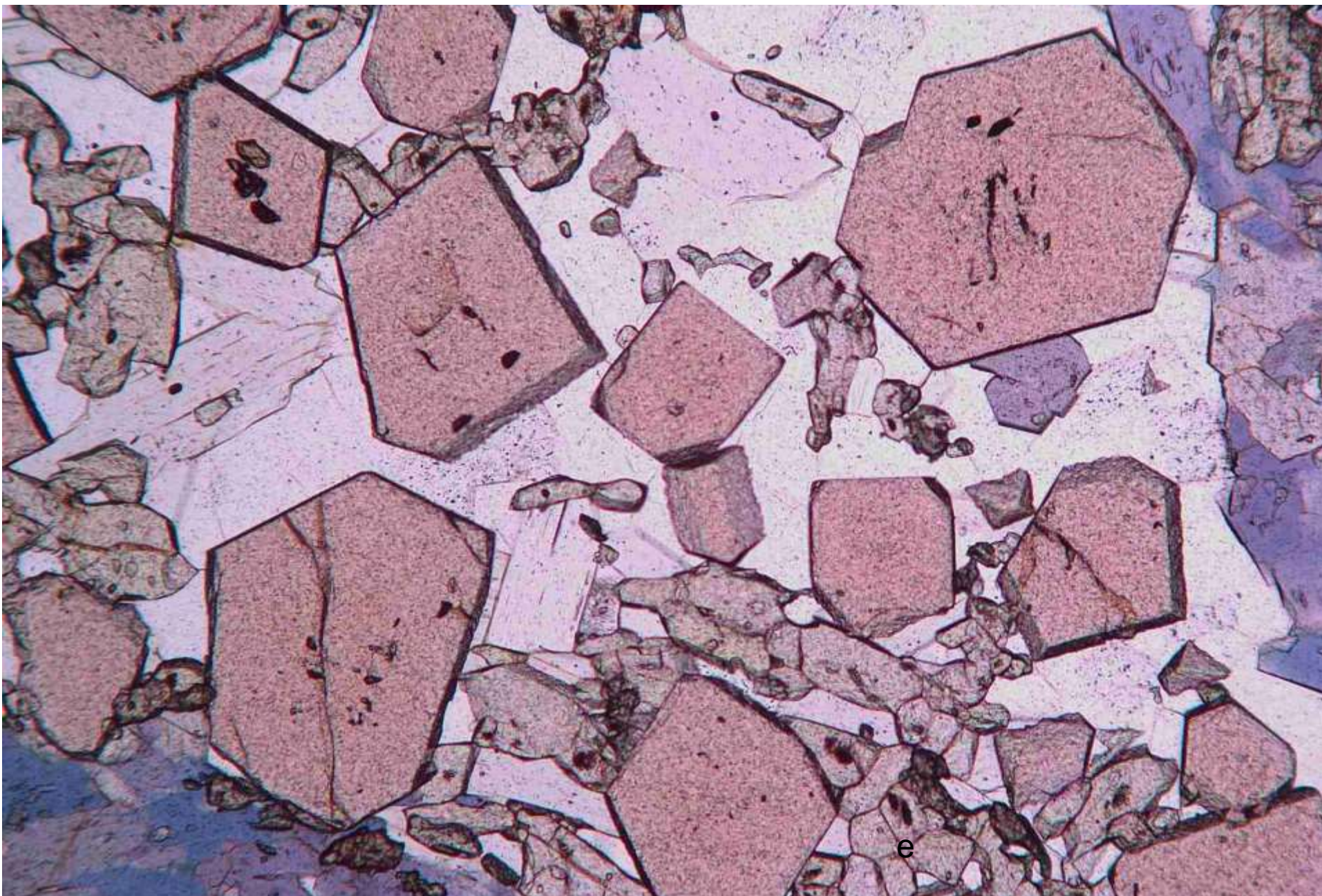
Garnet epidote glaucophane schist. Ward Creek, California, USA. xpol MP

Fluorite (var. 'blue john') with oscillatory zoning



Fluorite vein rock. Derbyshire, UK. ppl MP

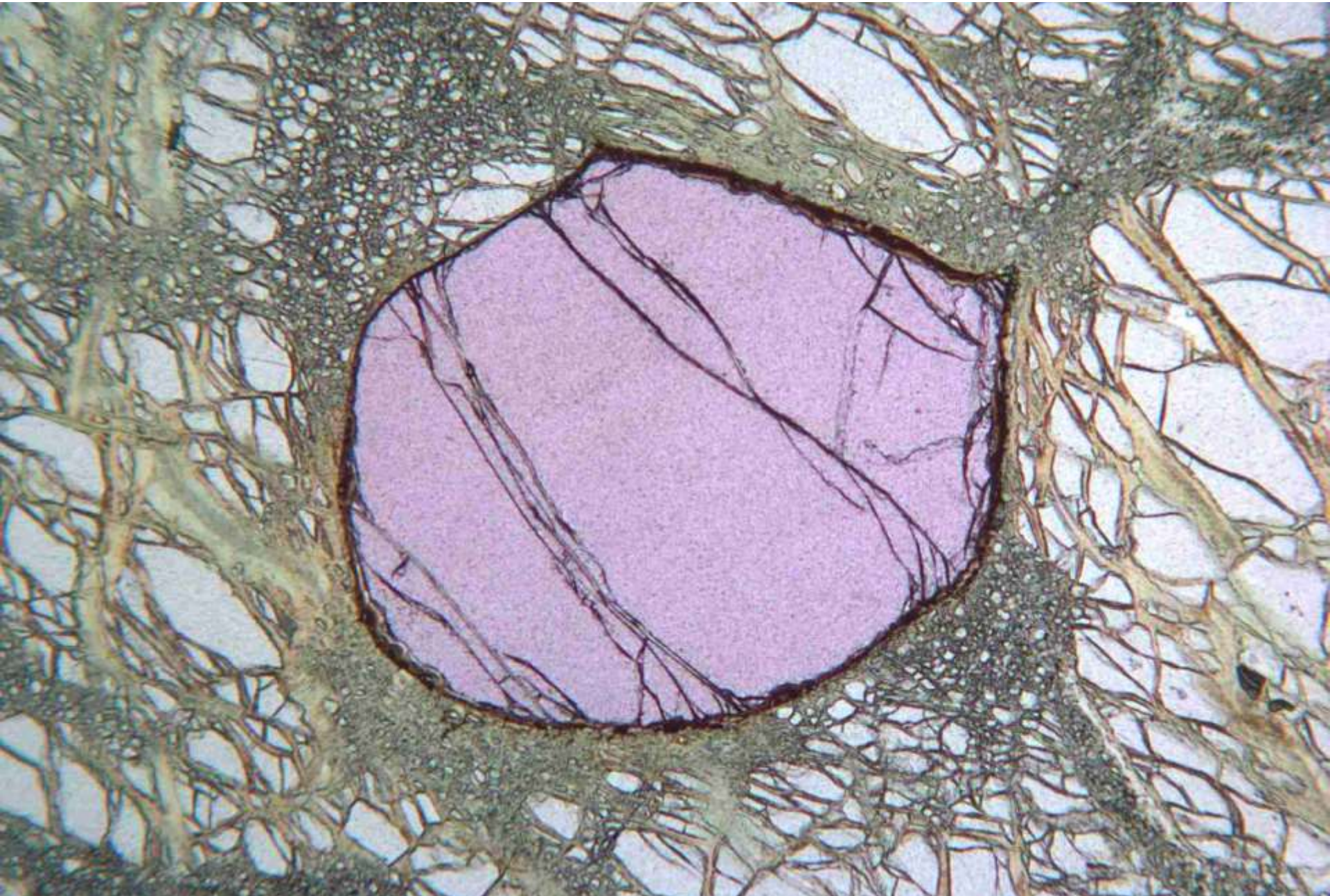
Garnet (var. almandine) (pink) with glaucophane (blue), epidote, white mica and quartz



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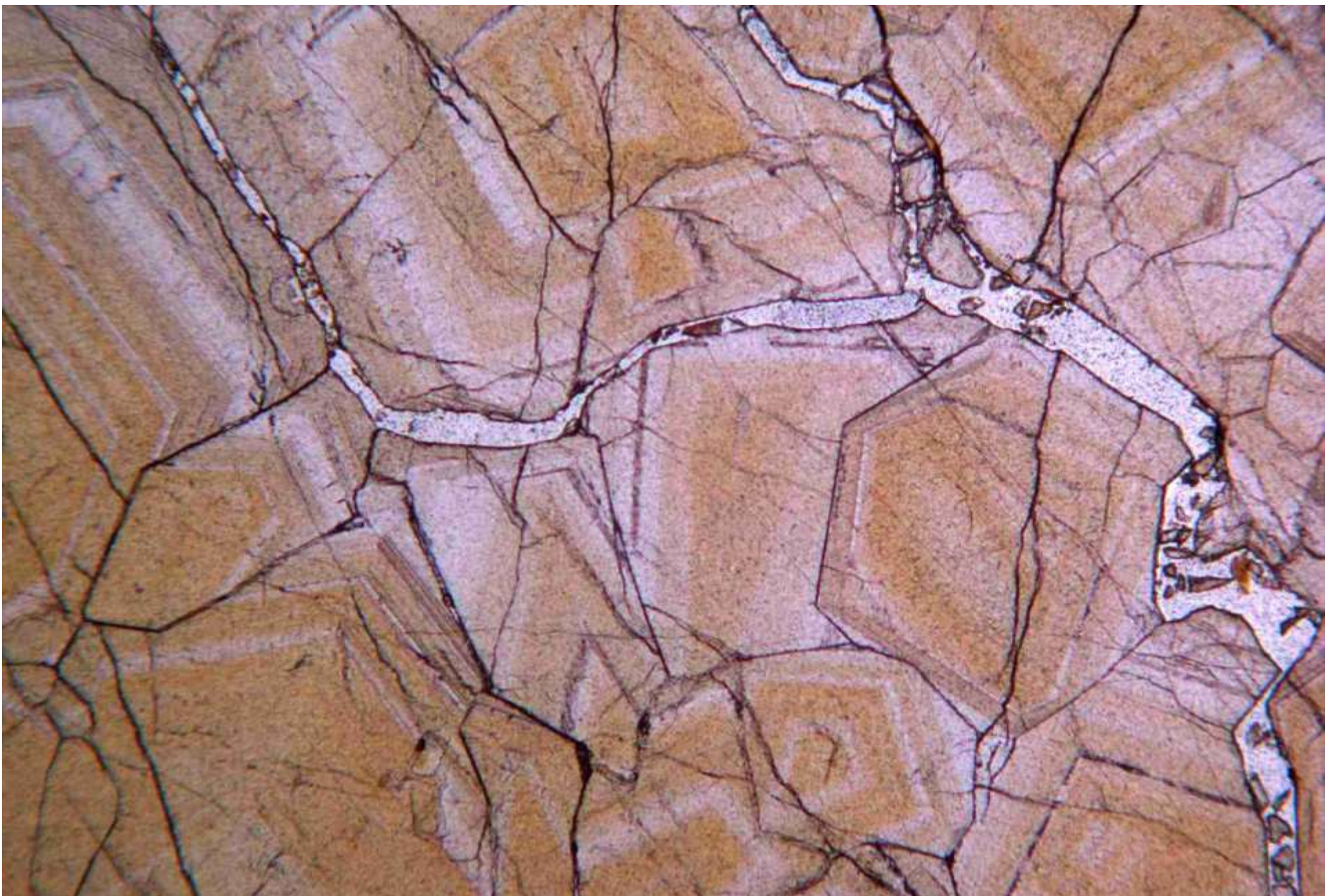
Garnet epidote glaucophane schist. Ward Creek, California, USA. ppl MP

Garnet (var. pyrope) with partially serpentinised olivine



Garnet peridotite (from nodule in kimberlite). Bultfontein, South Africa. ppl MP

Garnet (var. grossular-andradite) with oscillatory zoning



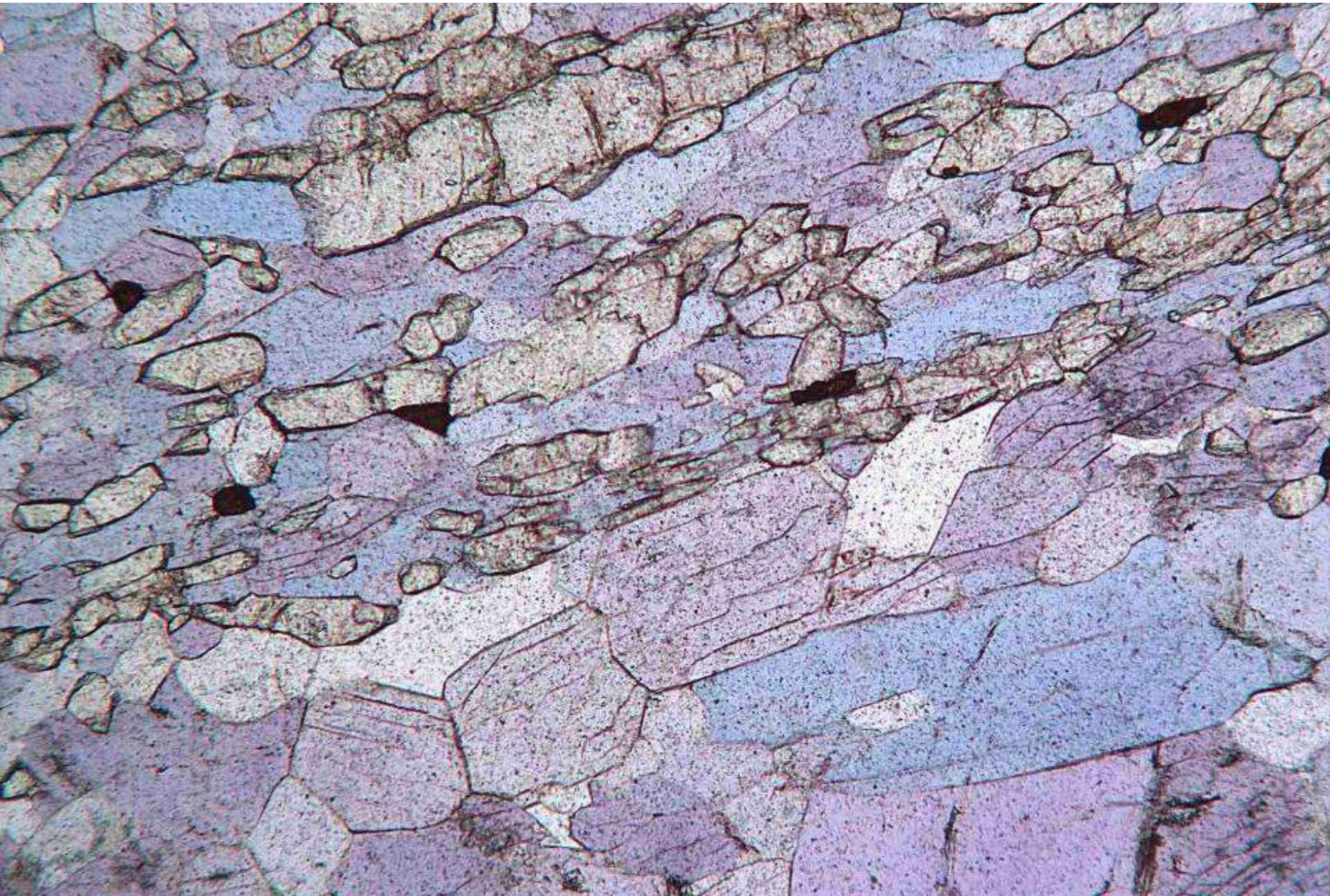
Garnet skarn. Norway. ppl MP

Same view under crossed polars



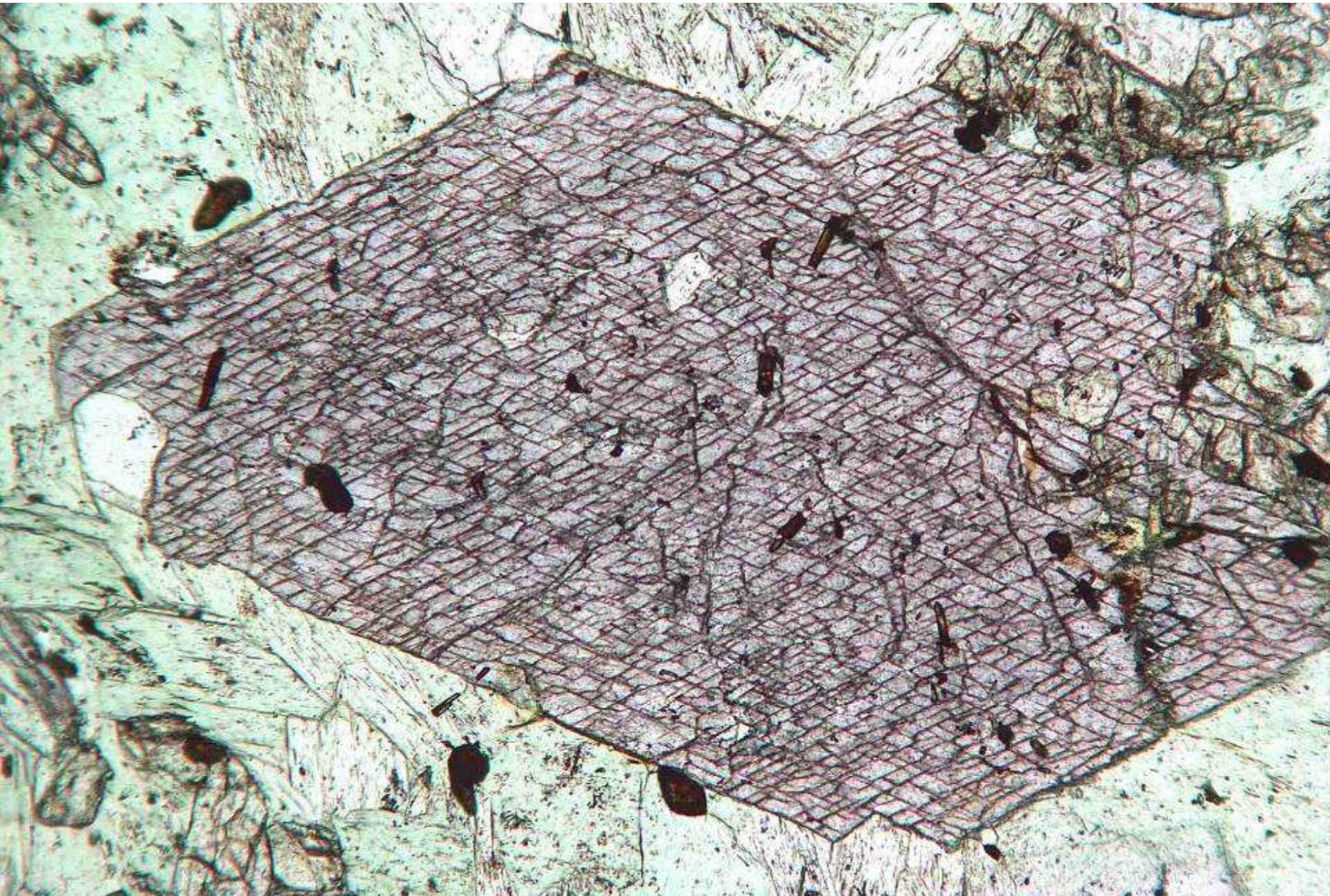
Garnet skarn. Norway. xpol MP

Glaucophane (lilac & blue) with epidote (high relief), white mica and rutile



Epidote glaucophane schist. Donnaz, Val d'Aosta, N Italy. ppl MP

Glaucophane cross section, showing cleavage, with epidote, chlorite and rutile



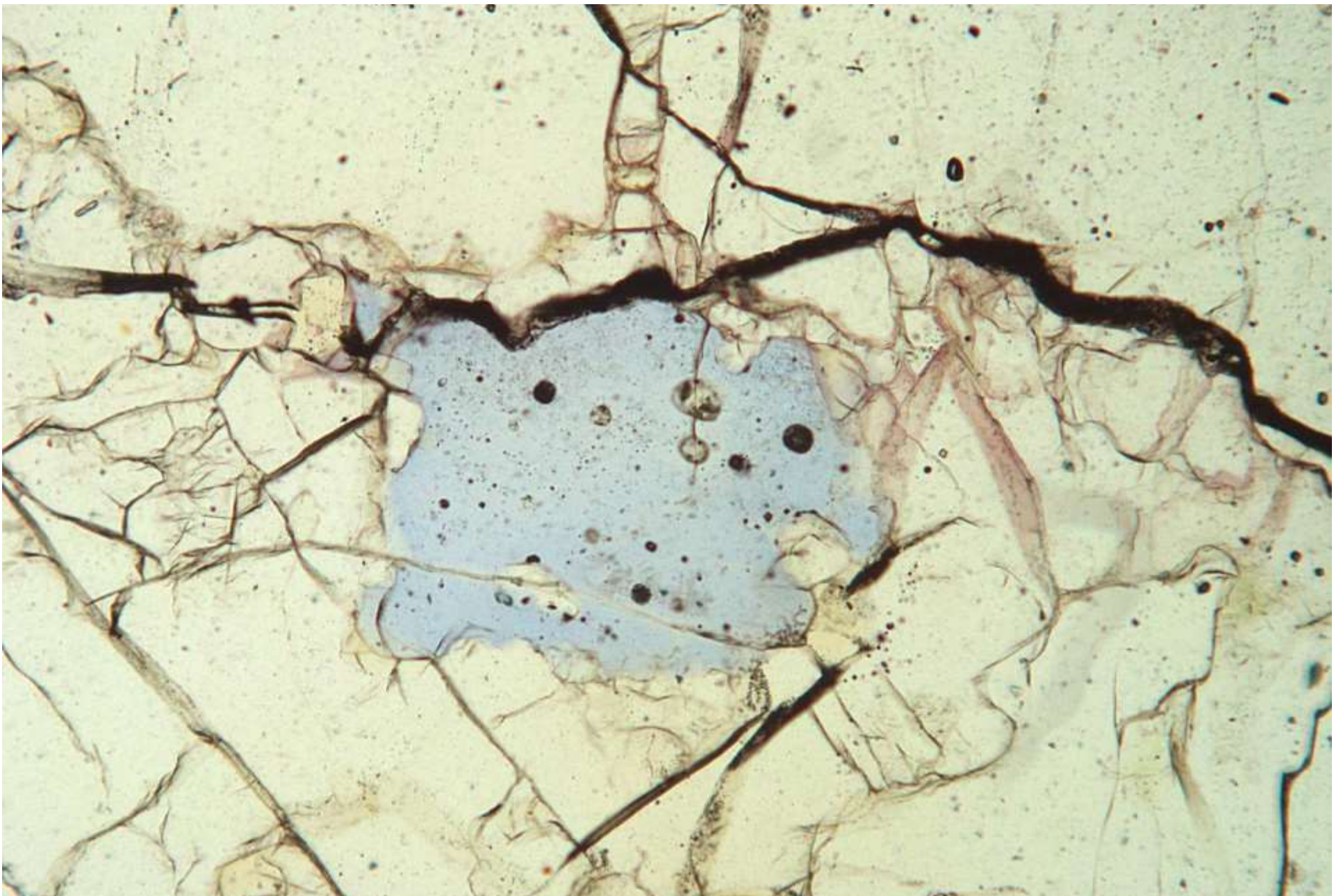
Garnet glaucophane chlorite granofels. Adler Pass, Switzerland. ppl MP

Glaucophane enclosing omphacite (green), quartz (colourless), rutile (dark) and garnet



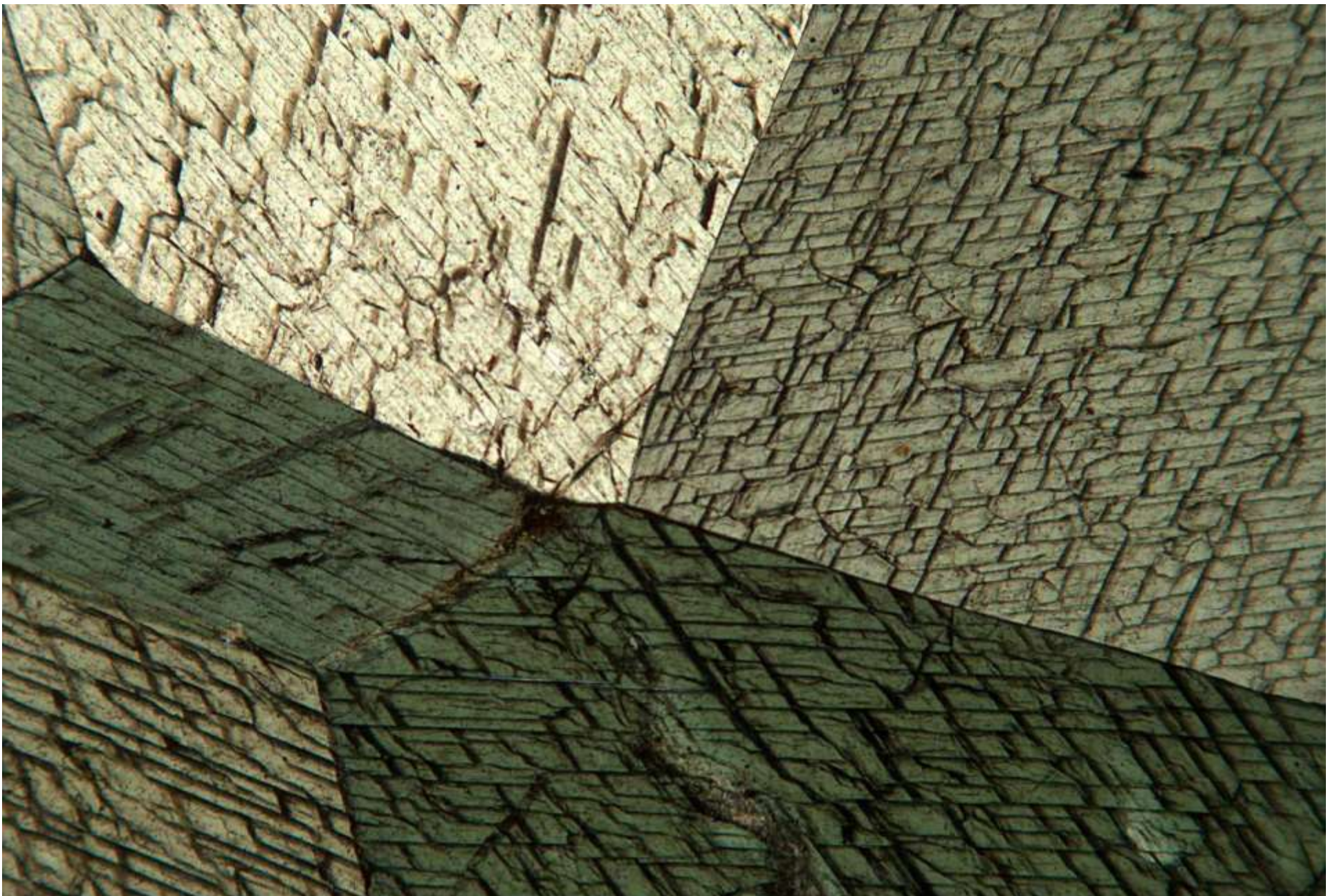
Glaucophane quartz eclogite. Syros, Greece. ppl MP

Hauyne (blue) with alkali feldspar (var. sanidine)



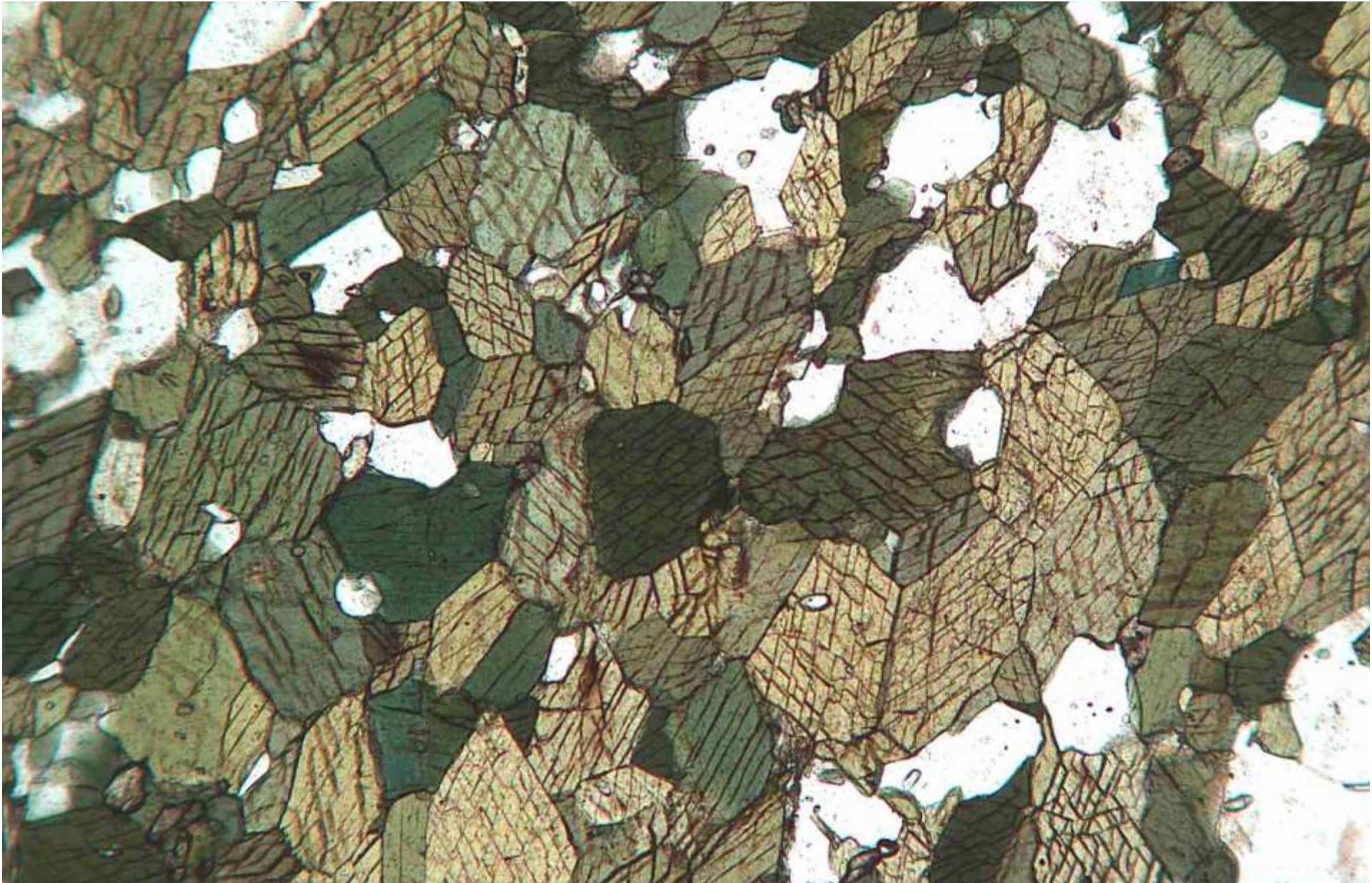
Hauyne sanidinite. Laacher See, Eifel, Germany. ppl MP

Hornblende in various orientations showing cleavage and pleochroism



Hornblendite. Locality unknown. ppl MP

Hornblende, mainly cross sections, showing cleavage and pleochroism.
Also present: plagioclase and quartz (both colourless)



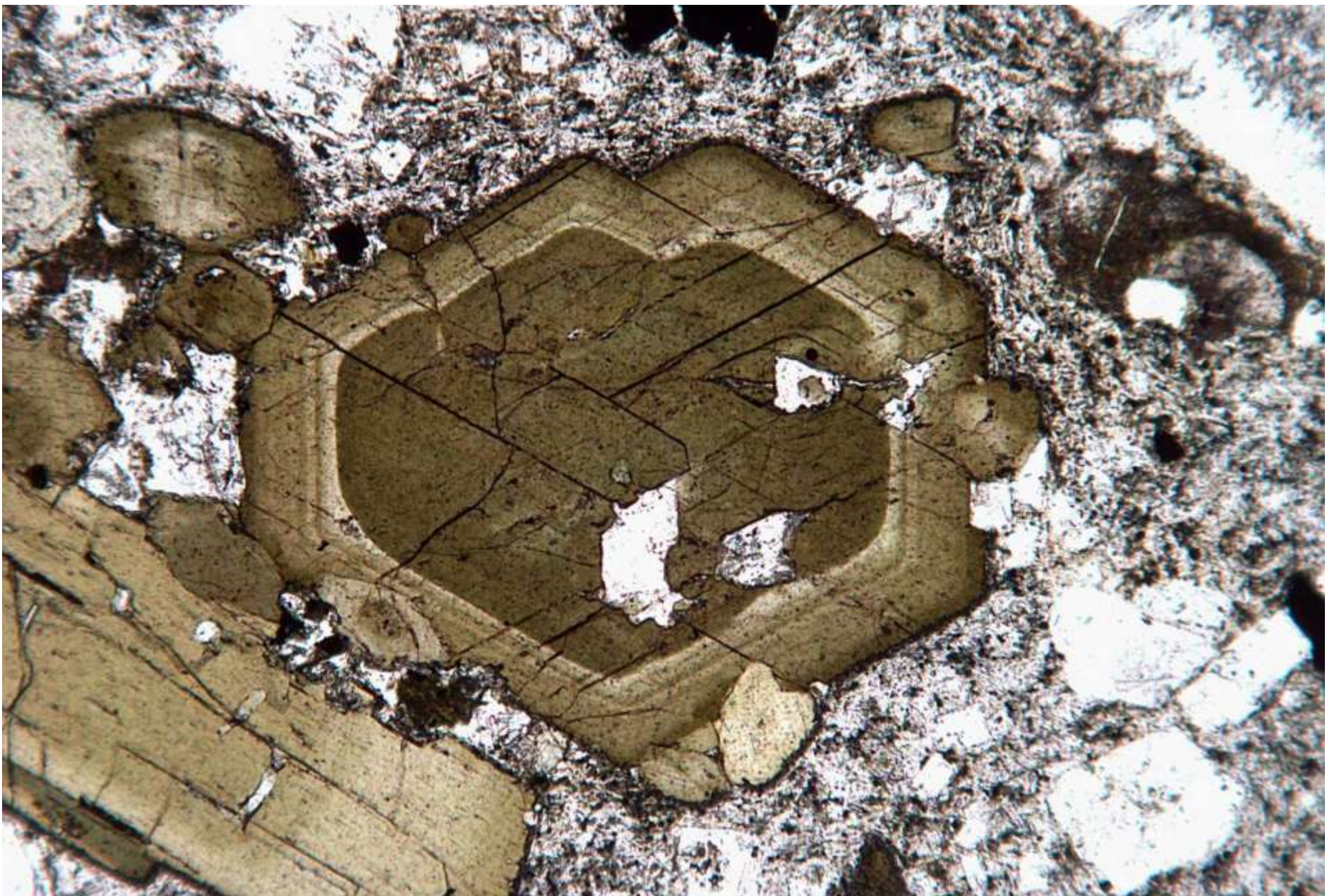
Amphibolite. Loch Maree, Scotland. ppl MP

Hornblende with multiple twinning. Also present: plagioclase, quartz and biotite



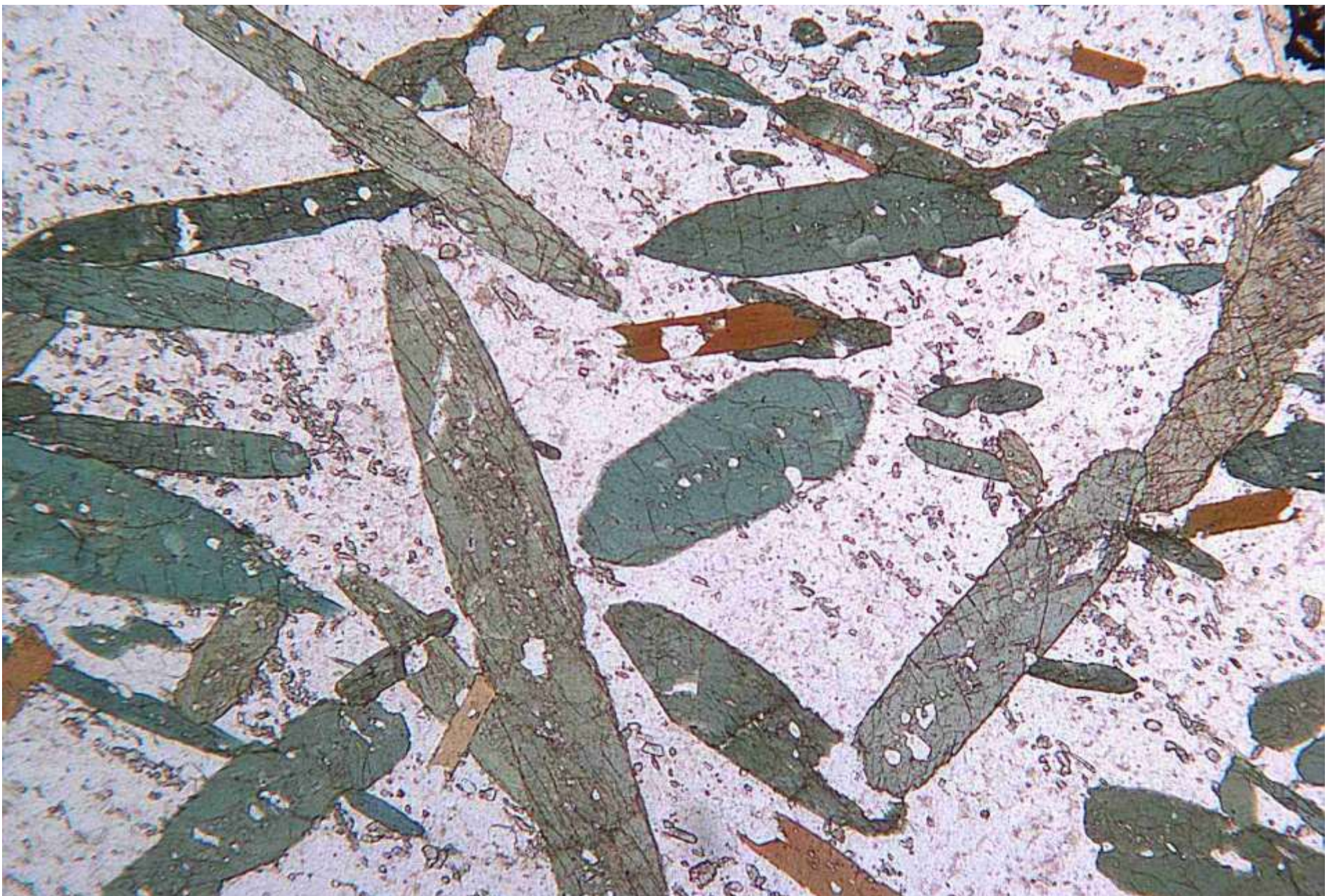
Diorite. Lochawe, Scotland. xpol HP

Hornblende with spectacular zoning in a groundmass of plagioclase etc



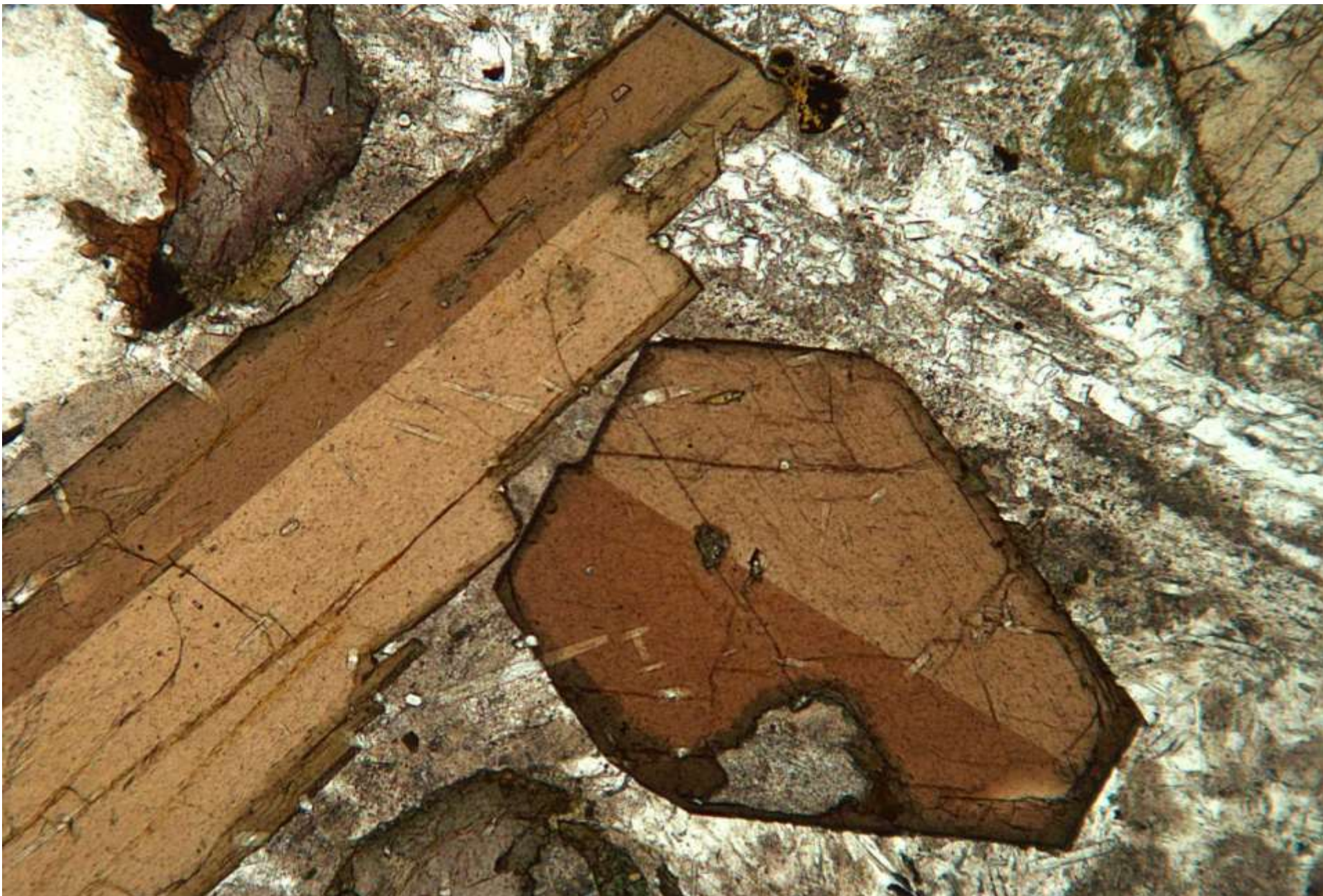
Andesite. Czech Republic. ppl MP

Hornblende (greens) with plagioclase, epidote and biotite



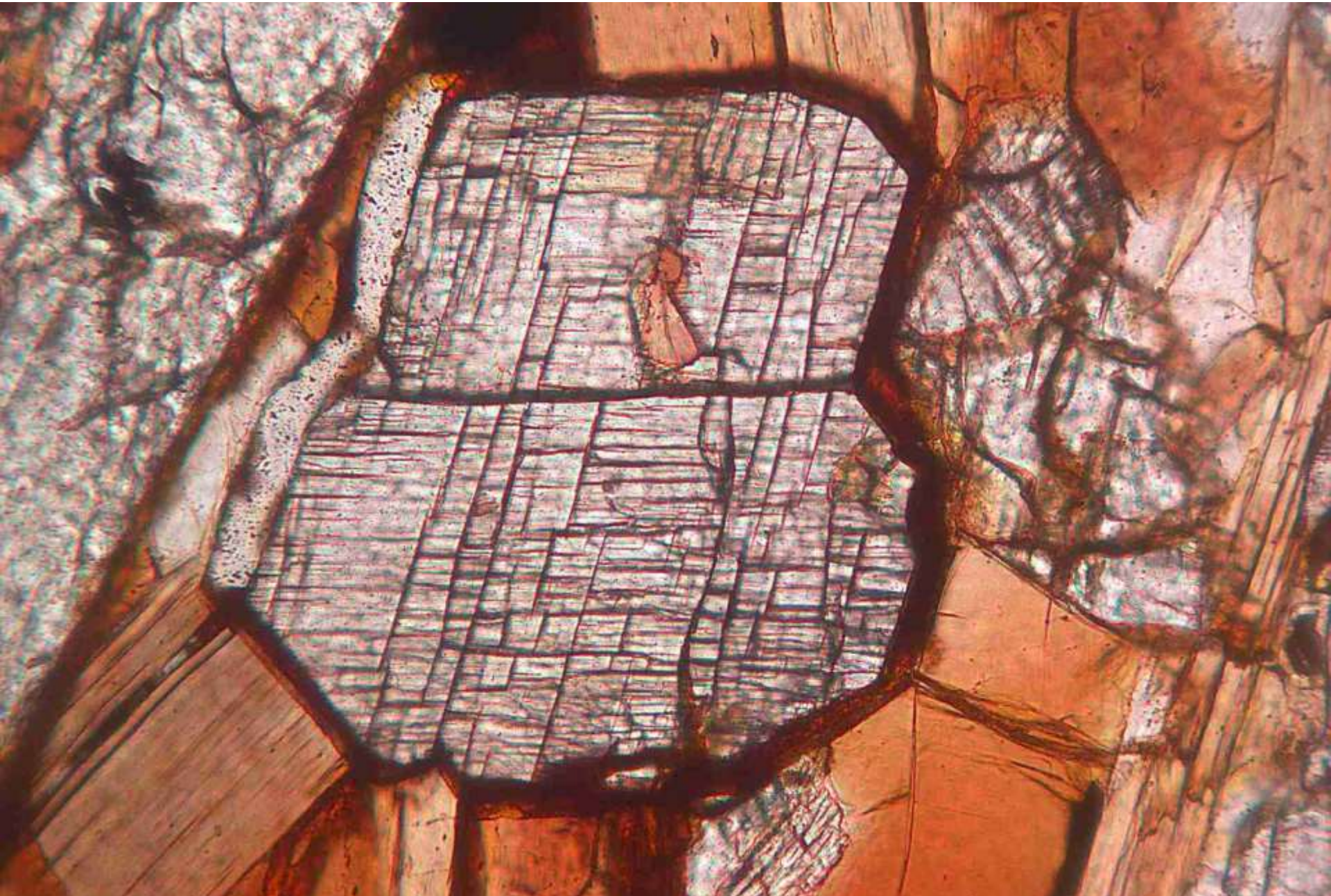
Amphibolite. Loch Carron, Scotland. ppl LP

Kaersutite with simple twinning and zoning. Also present: augite and plagioclase



Syenogabbro ('teschenite'). Locality unknown. ppl MP

Kyanite cross-section, showing cleavage, with biotite.



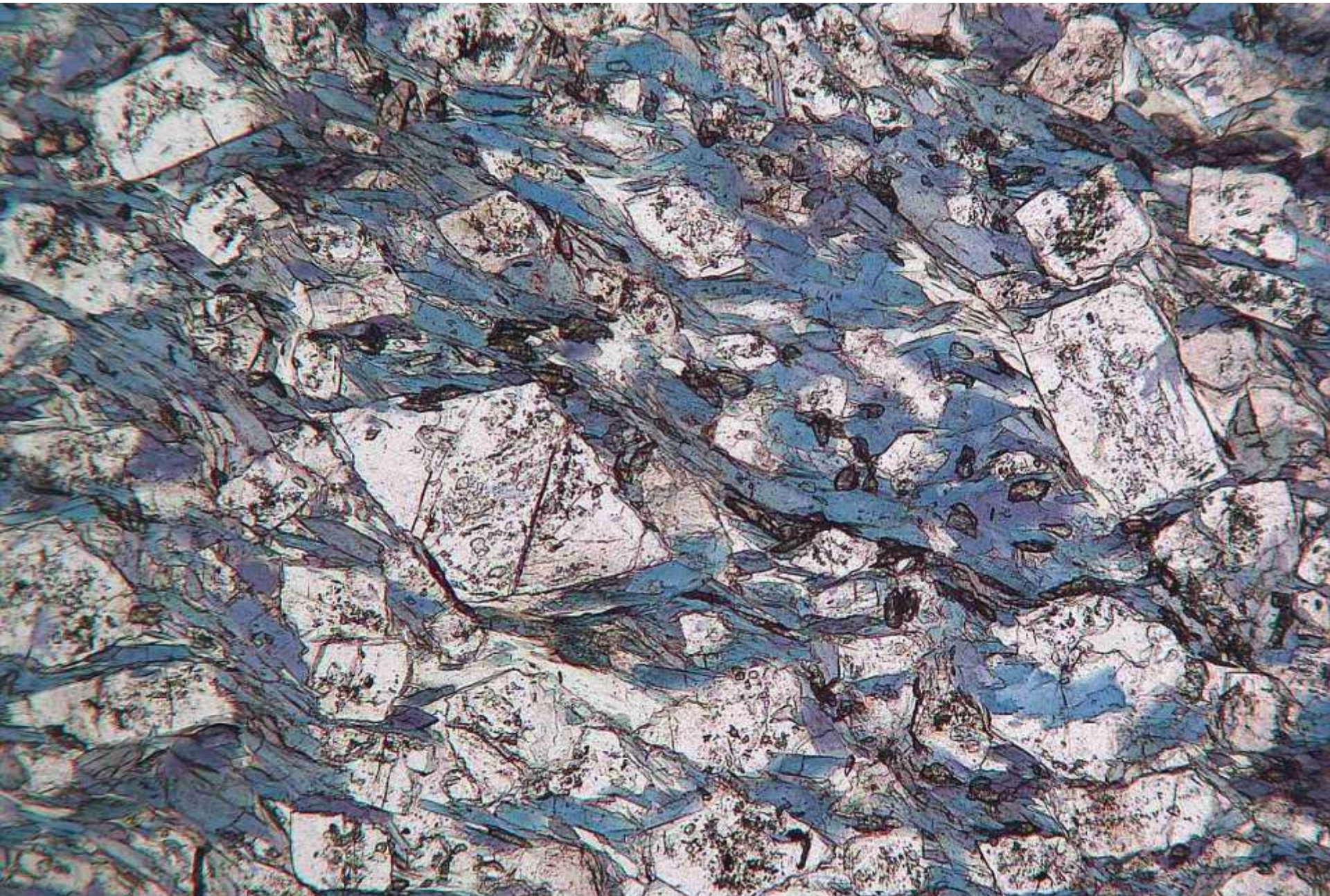
Garnet kyanite biotite schist. Tarbert, NW Scotland. ppl HP

Låvenite (yellow) with arfvedsonite (dark) and nepheline



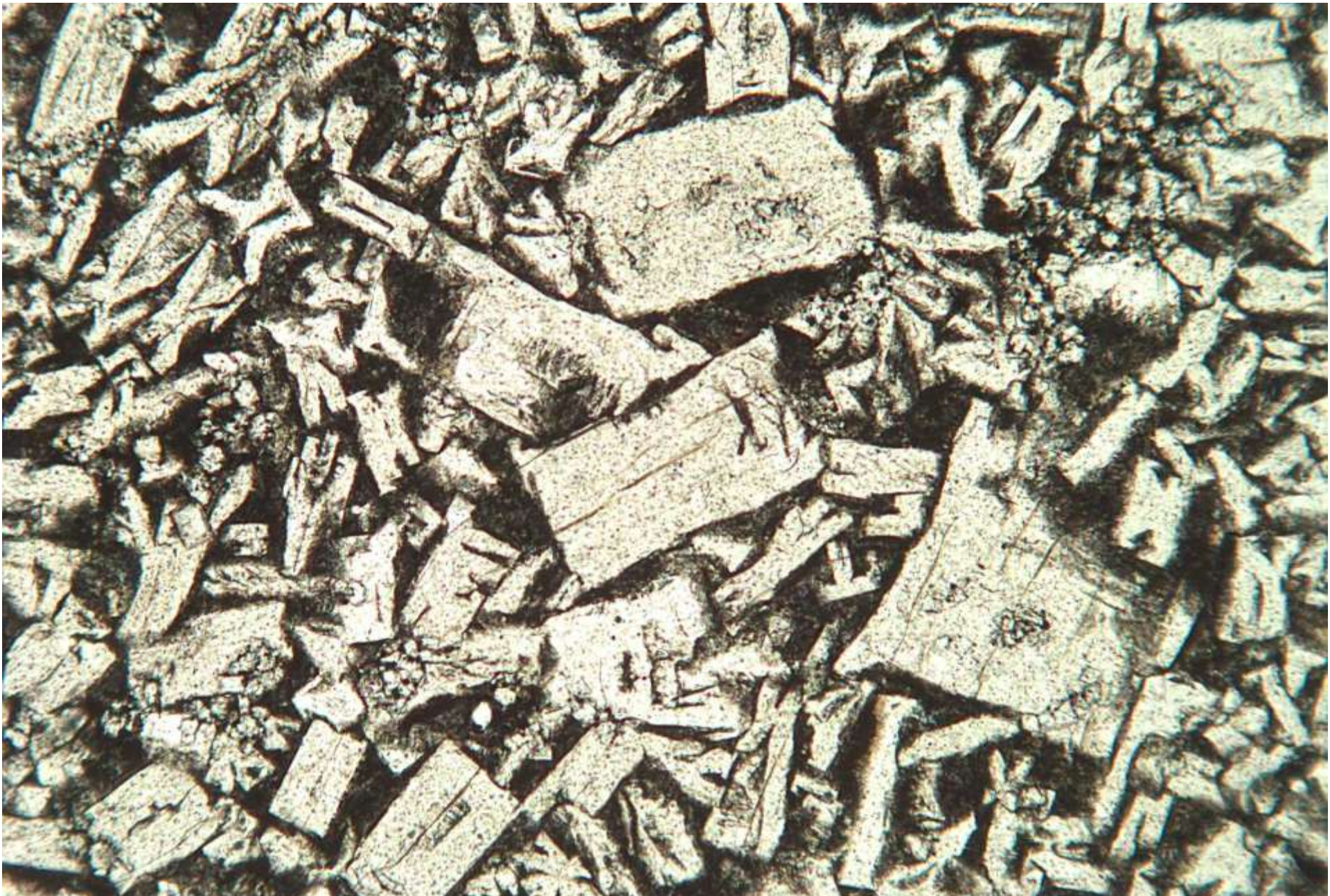
Nepheline syenite pegmatite. Kirovsk, Kola Peninsula, Russia. ppl MP

Lawsonite (colourless) with glaucophane



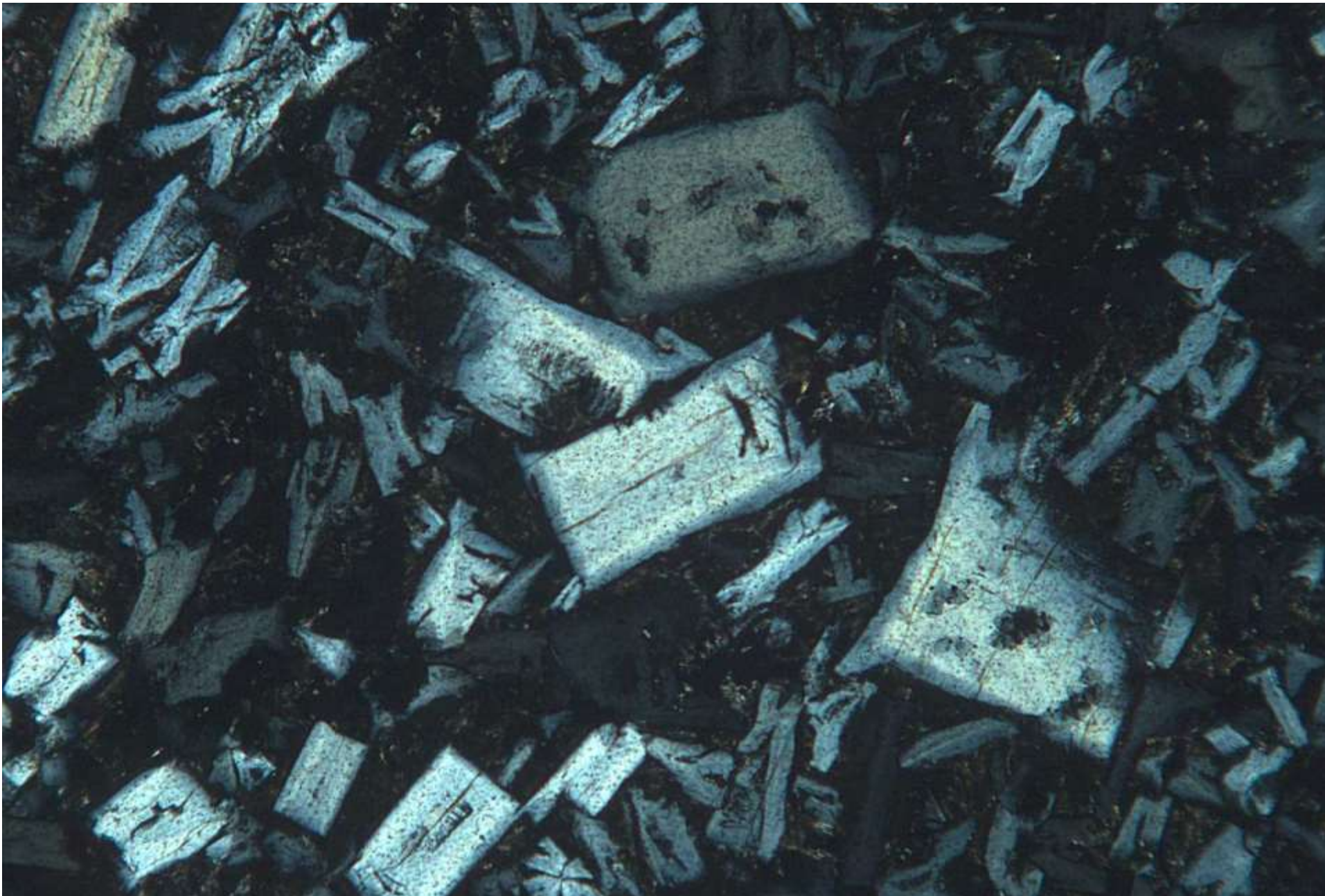
Lawsonite glaucophane schist. Orhaneli, Tavşanlı, NW Turkey. ppl MP

Melilite in glass



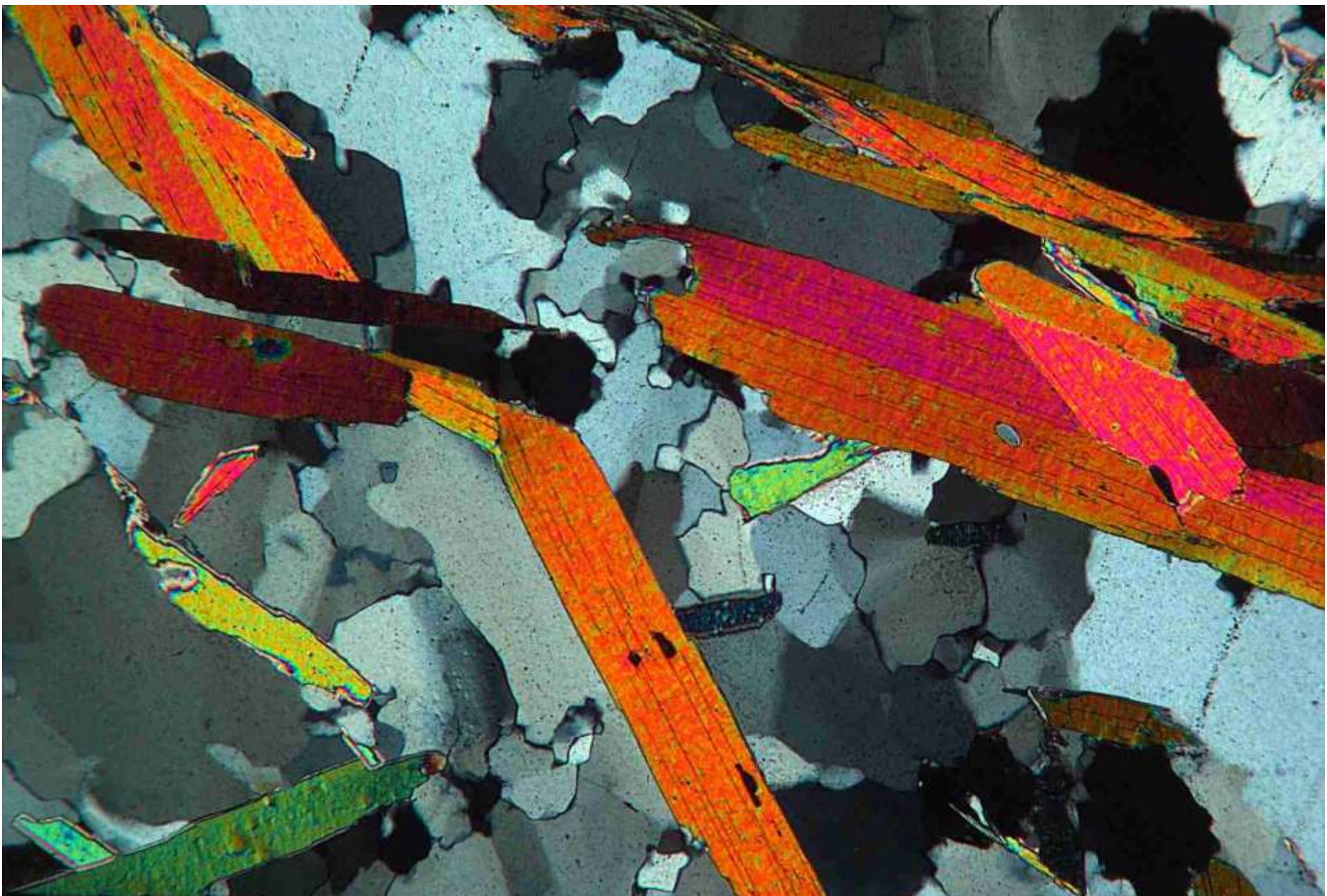
Melilite slag. Northumberland. ppl MP

Same view under crossed polars



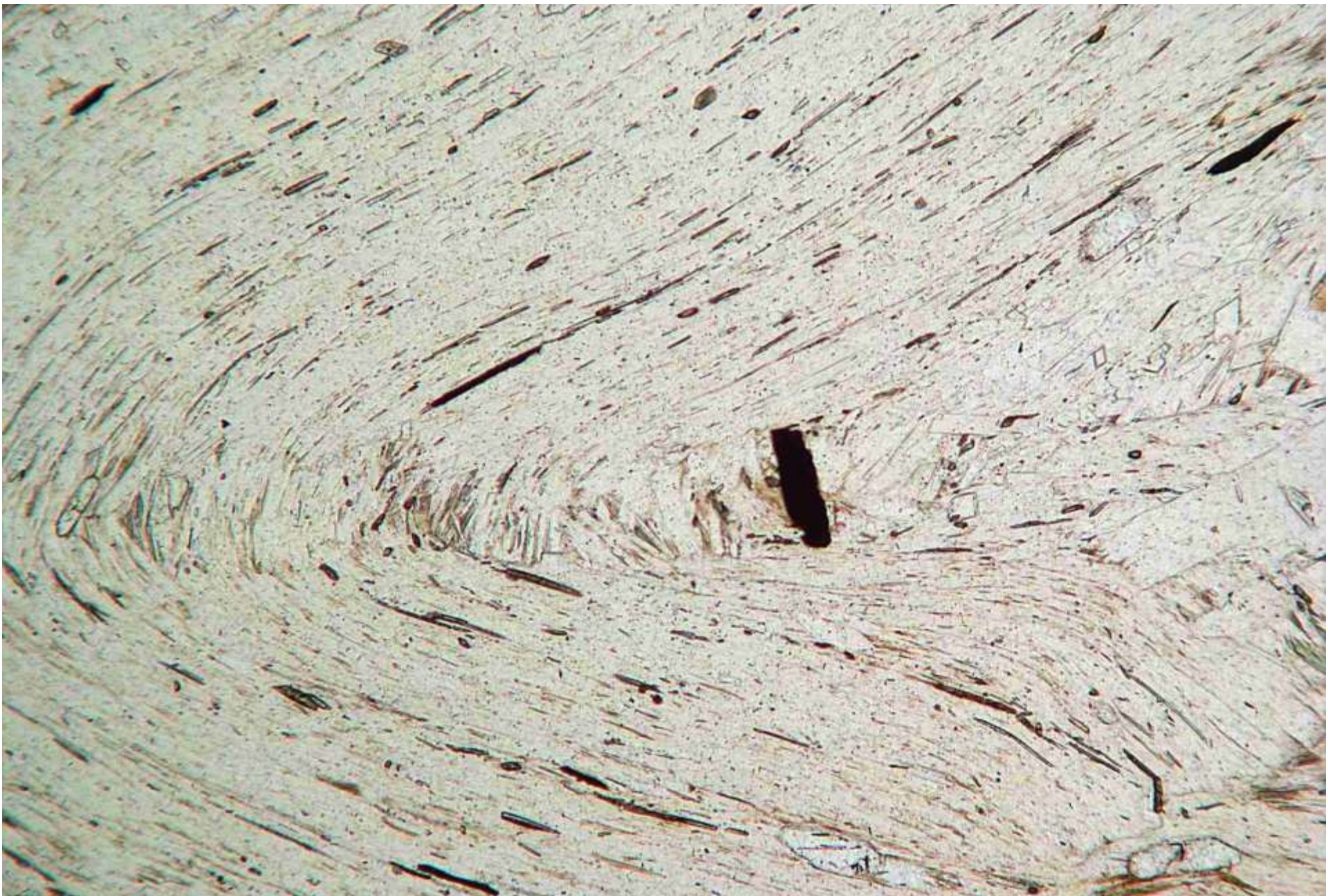
Melilite slag. Northumberland. xpol MP

Muscovite (bright interference colours) with quartz



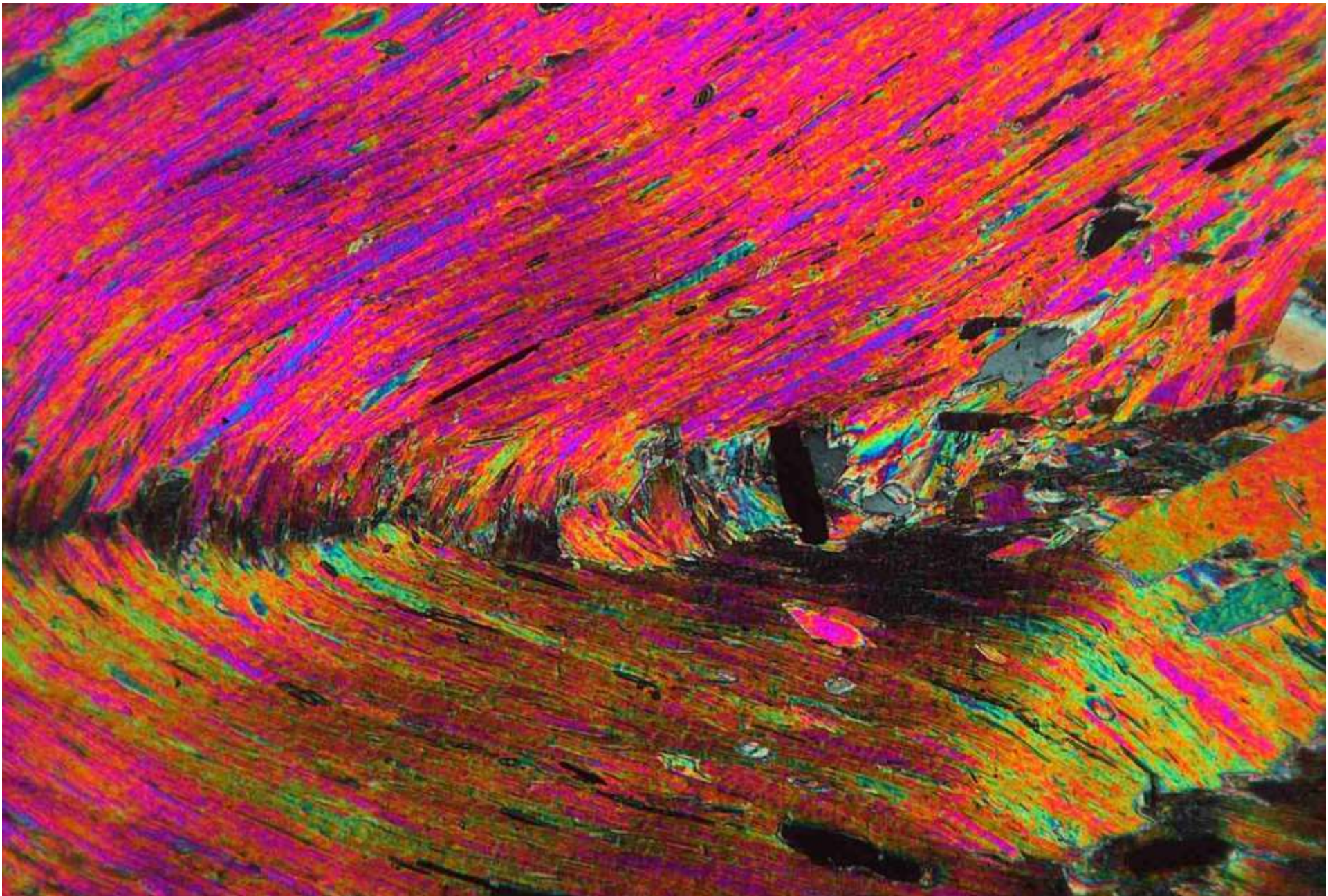
Garnet mica schist. Dorfer Tal, Austria. xpol MP

Aligned muscovite flakes defining a schistosity which has been folded



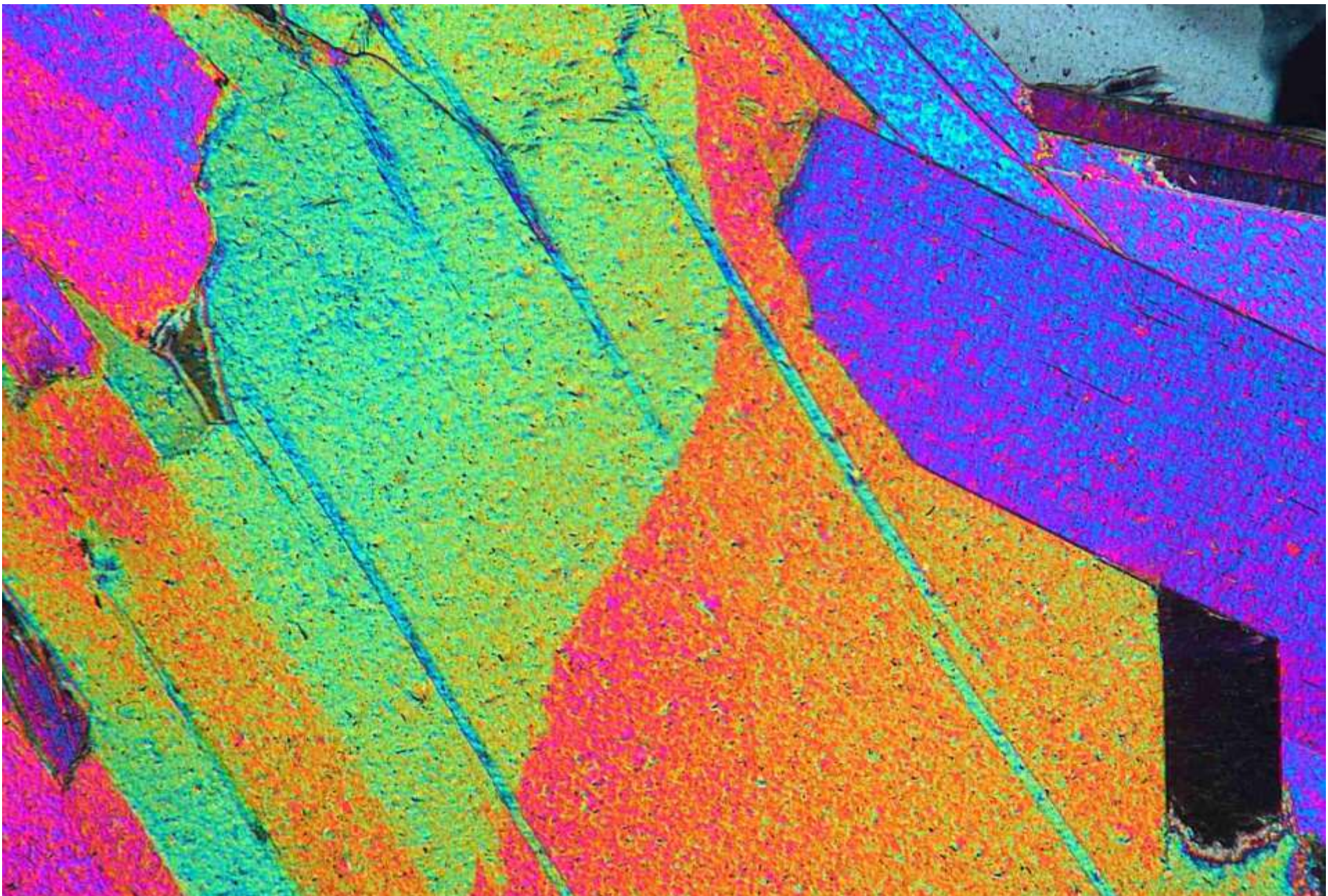
Garnet mica schist. Tauern Tal, Mallnitz, Austria. ppl MP

Same view under crossed polars



Garnet mica schist. Tauern Tal, Mallnitz, Austria. xpol MP

Muscovite



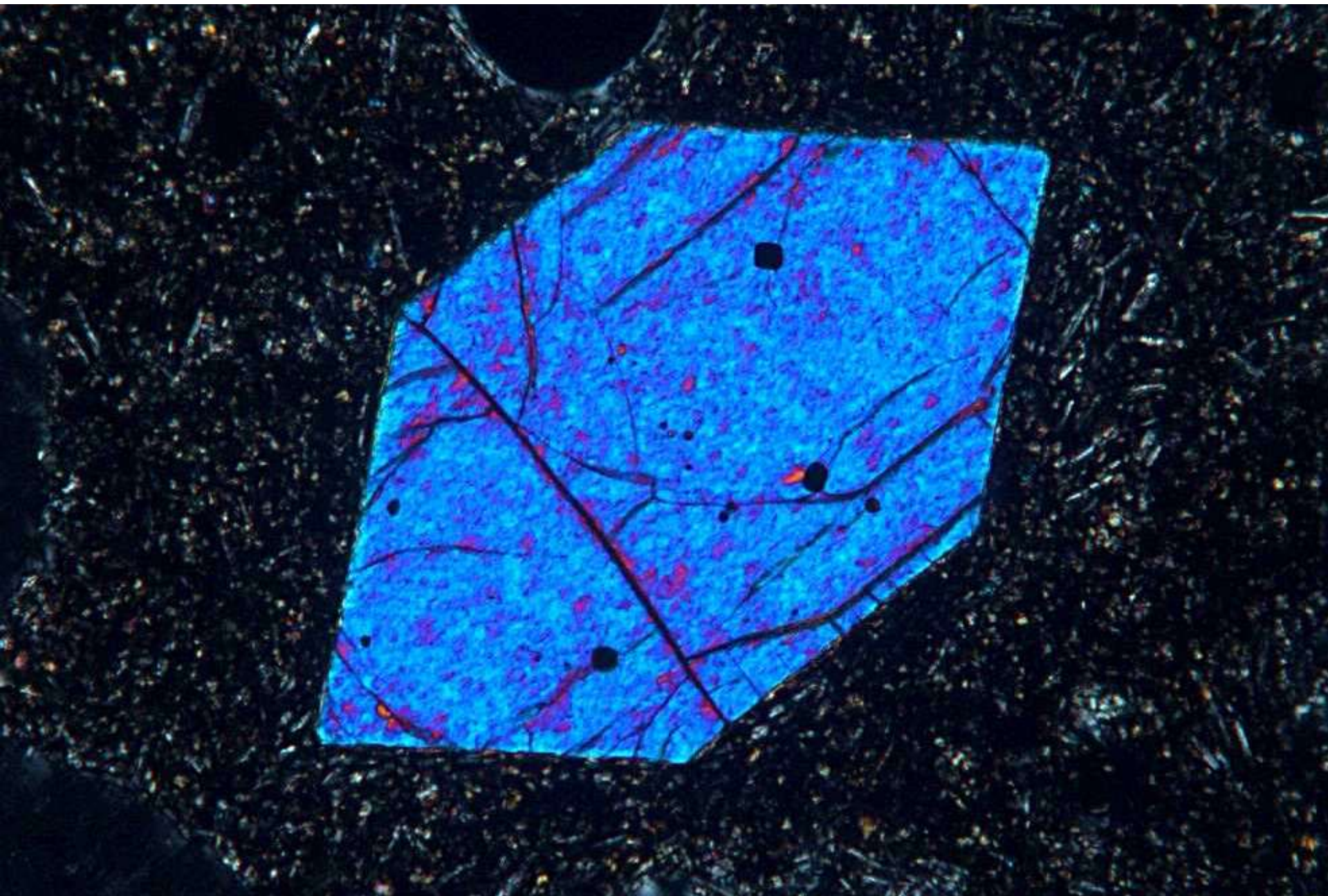
Eclogite. Montestrutto, Val d'Aosta, N Italy. xpol MP

Radiating natrolite crystals



Nepheline syenite. Cnoc Rhonastil, Islay, Scotland. xpol MP

Euhedral olivine crystal (var. forsterite) in glass. The round features are vesicles.



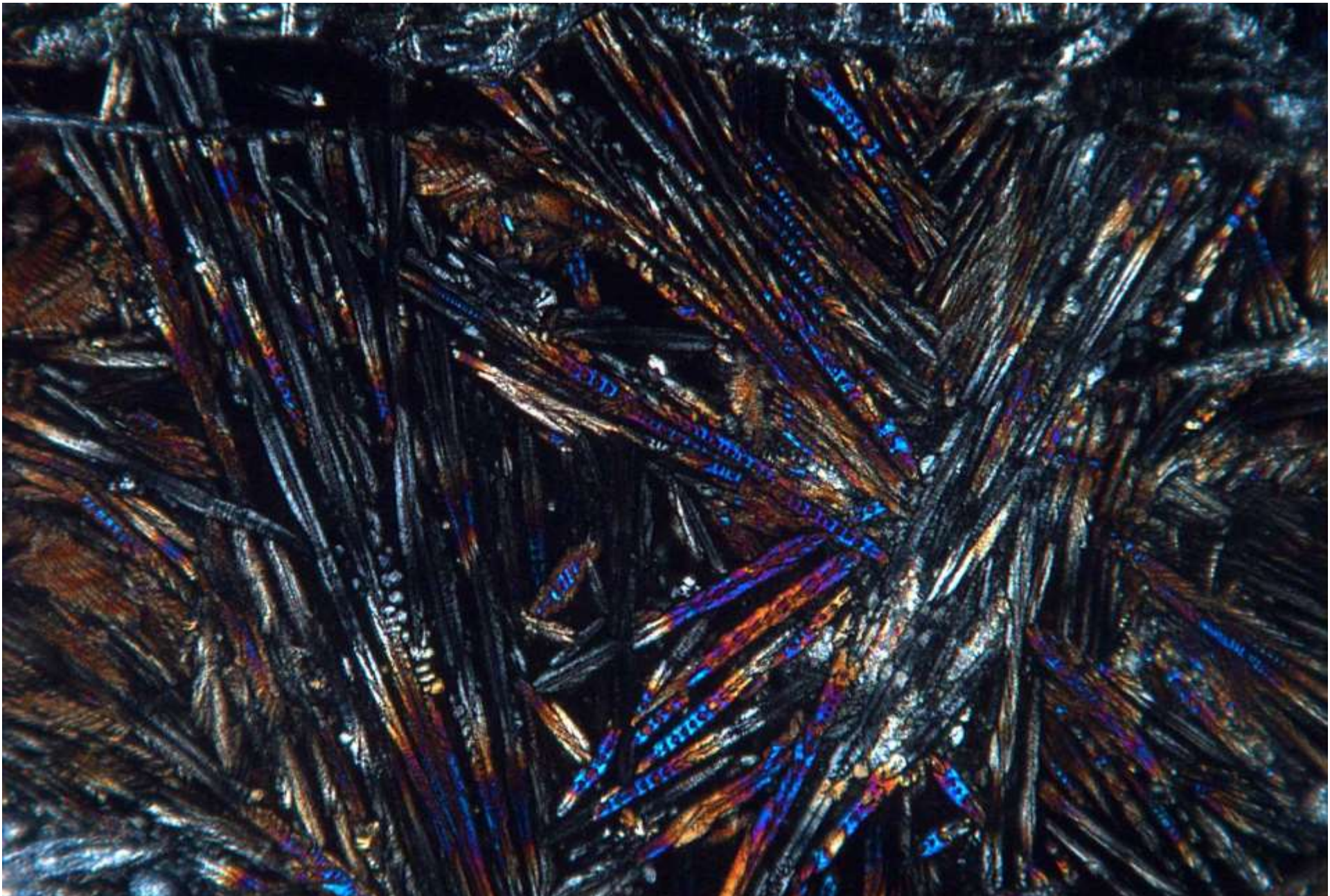
Olivine basalt. Réunion Island. xpol MP

Skeletal crystals of olivine (var. forsterite) displaying 'spinifex' texture



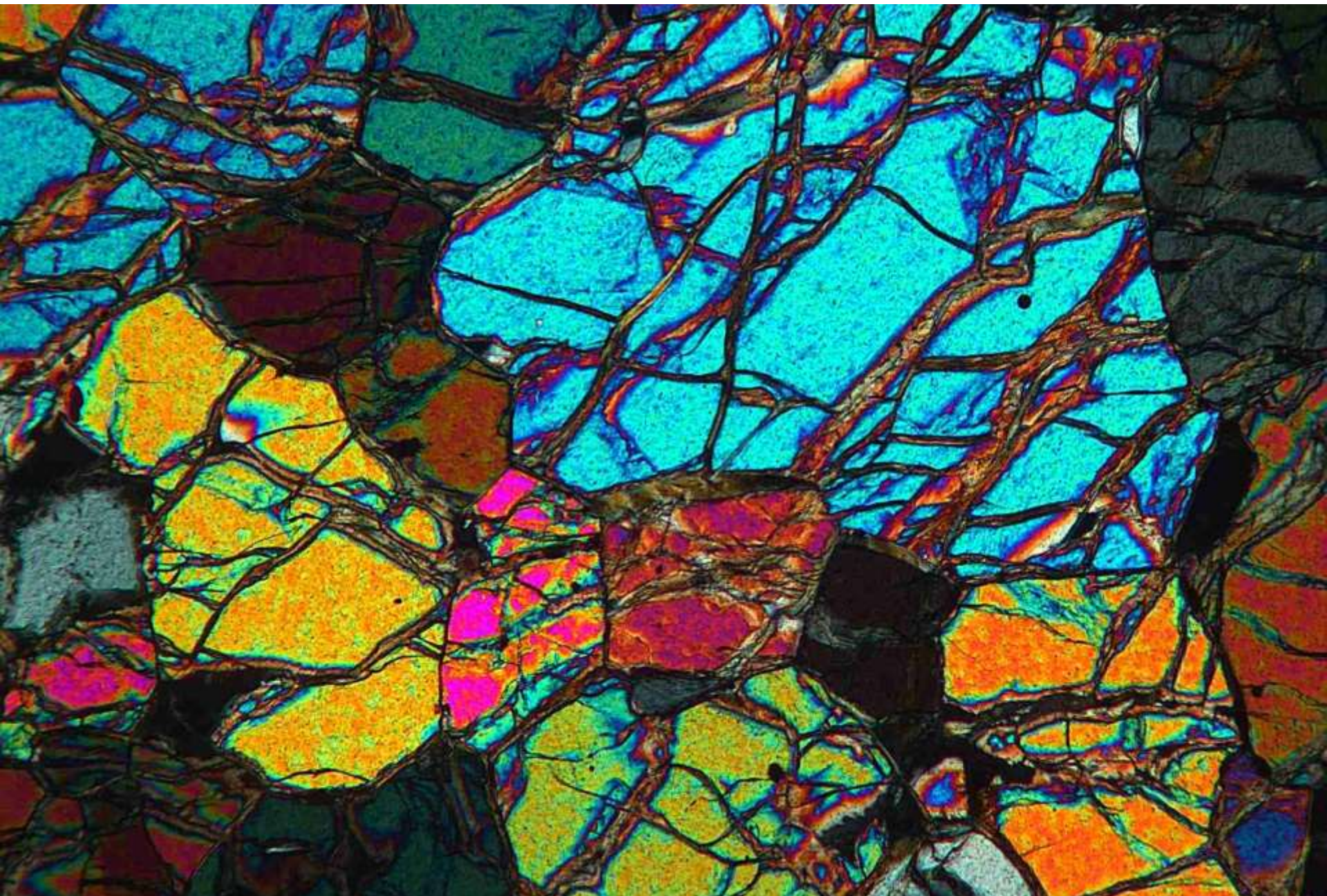
Komatiite. Belingwe, Zimbabwe. ppl MP

Same view under crossed polars



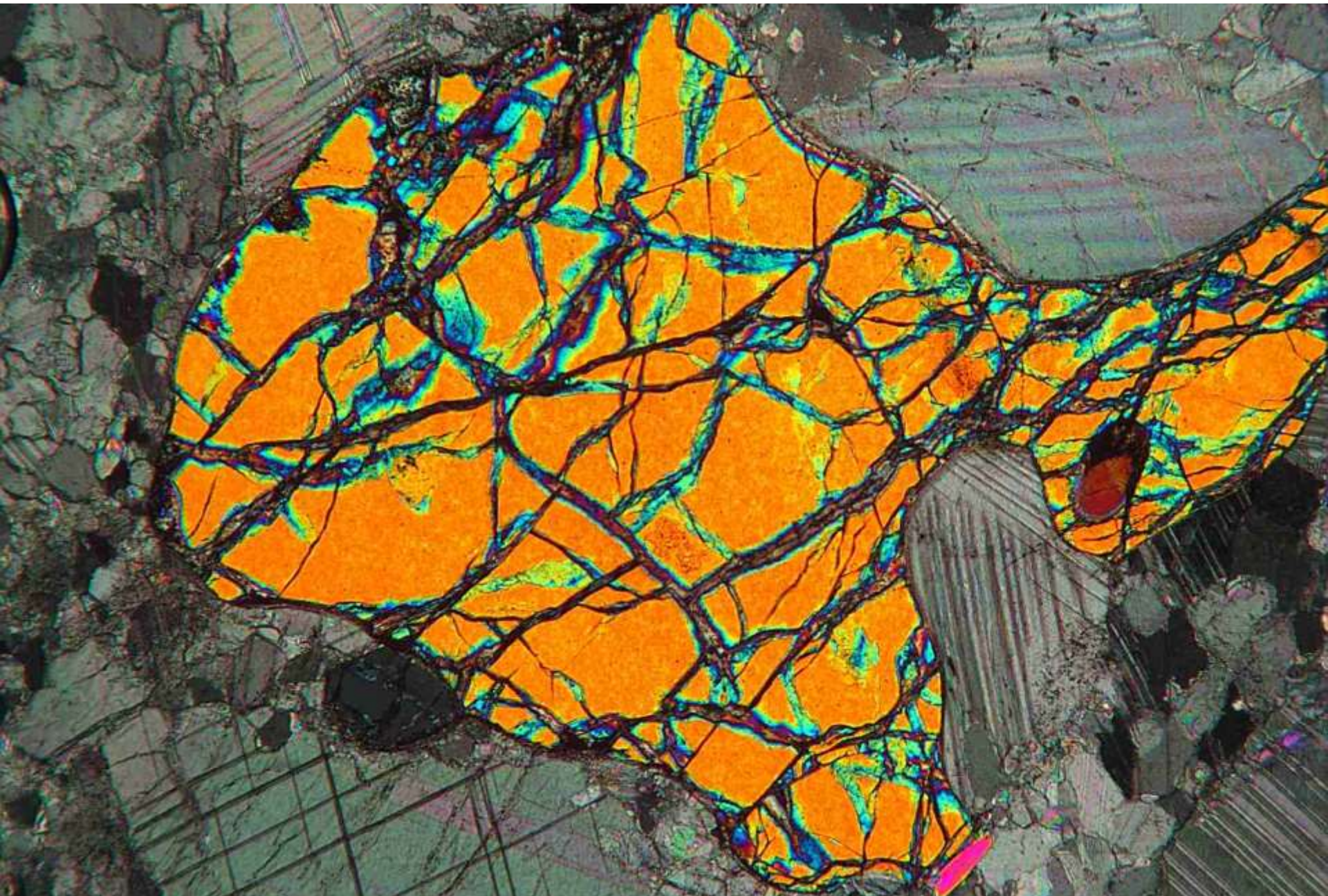
Komatiite. Belingwe, Zimbabwe. xpol MP

Olivine (var. forsterite)



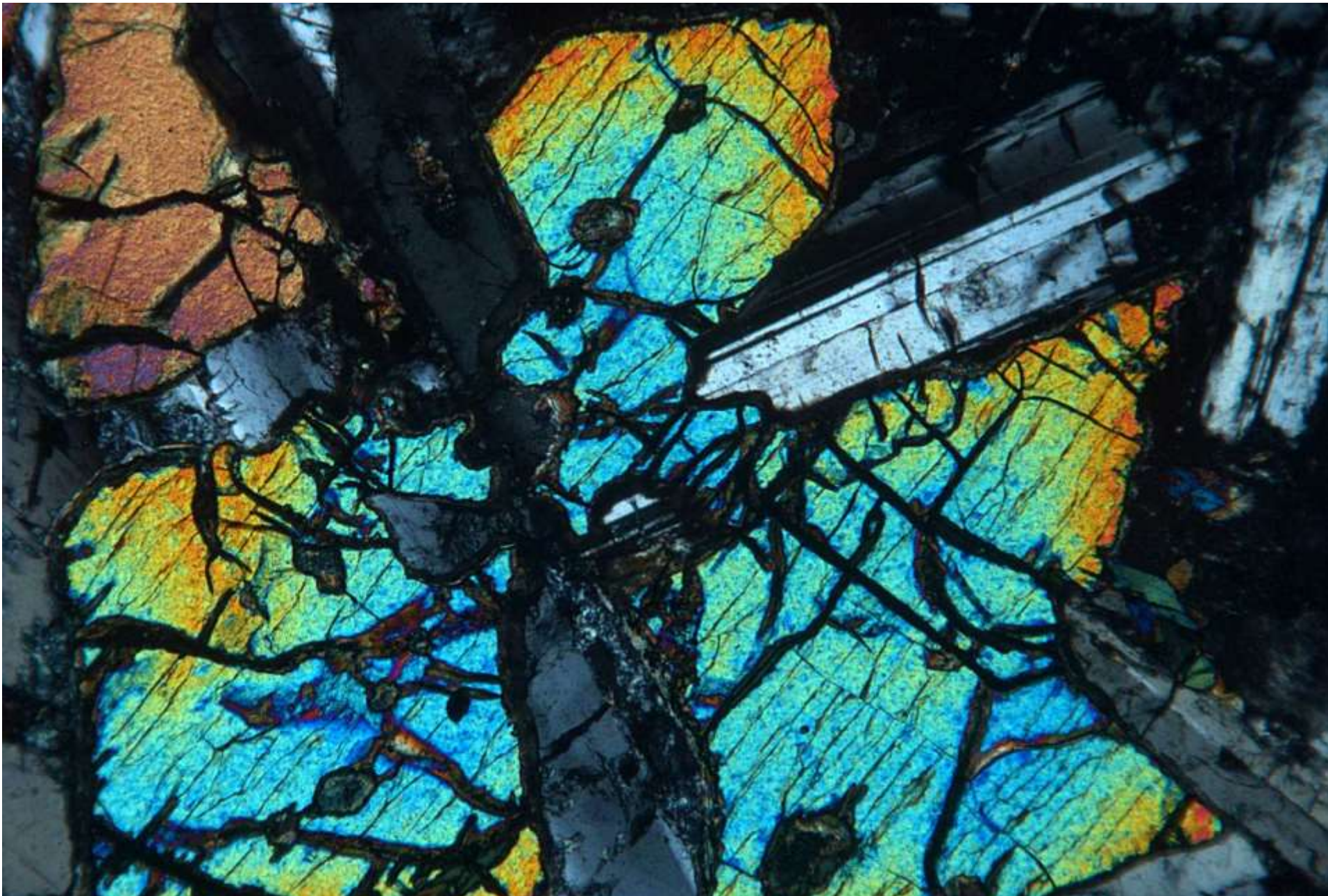
Peridotite. West Norway. xpol MP

Olivine (var. forsterite) with calcite and dolomite



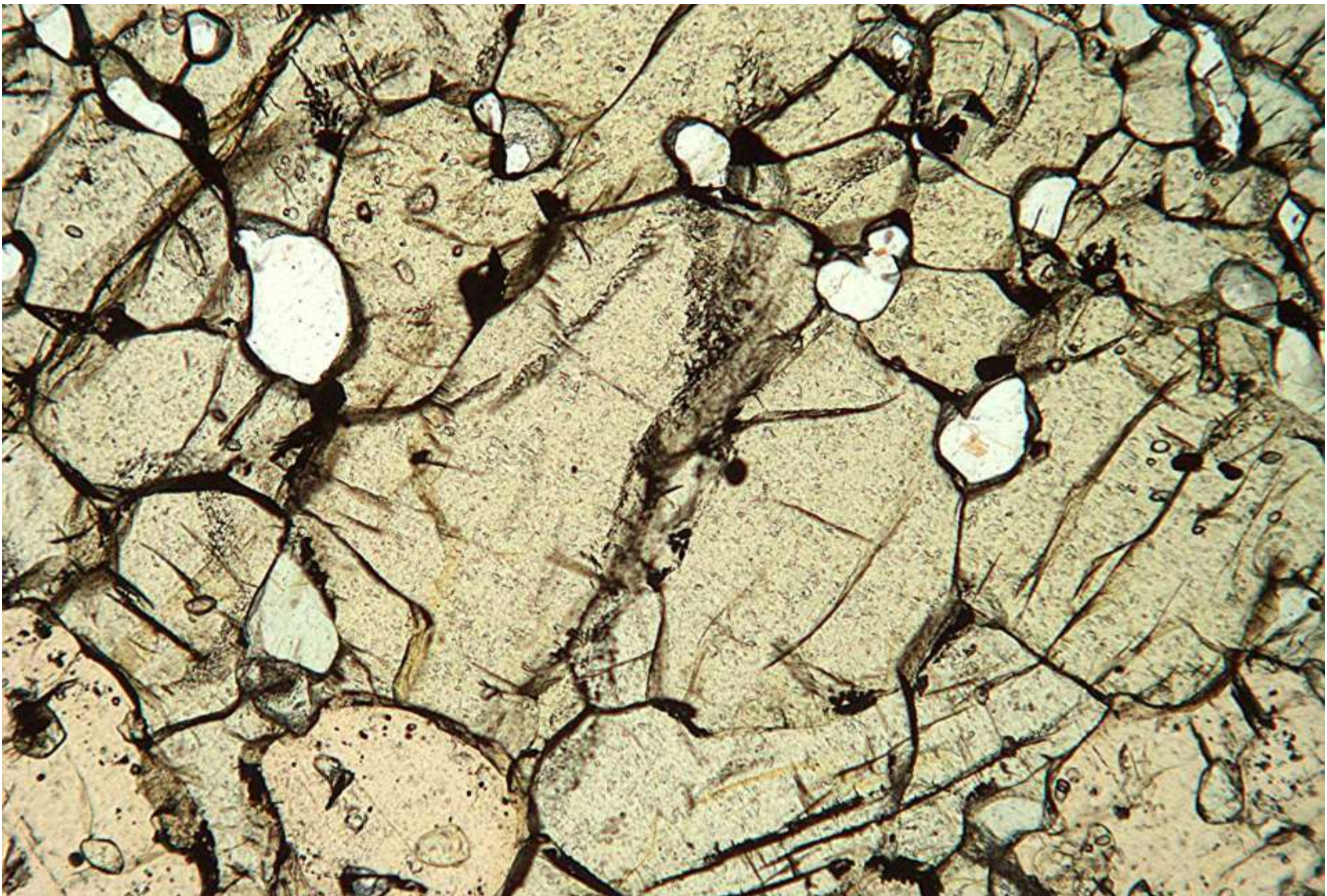
Forsterite marble. Rodel, S Harris, Scotland. xpol MP

Zoned olivine with rimwards increasing Fe/Mg. Also present: plagioclase



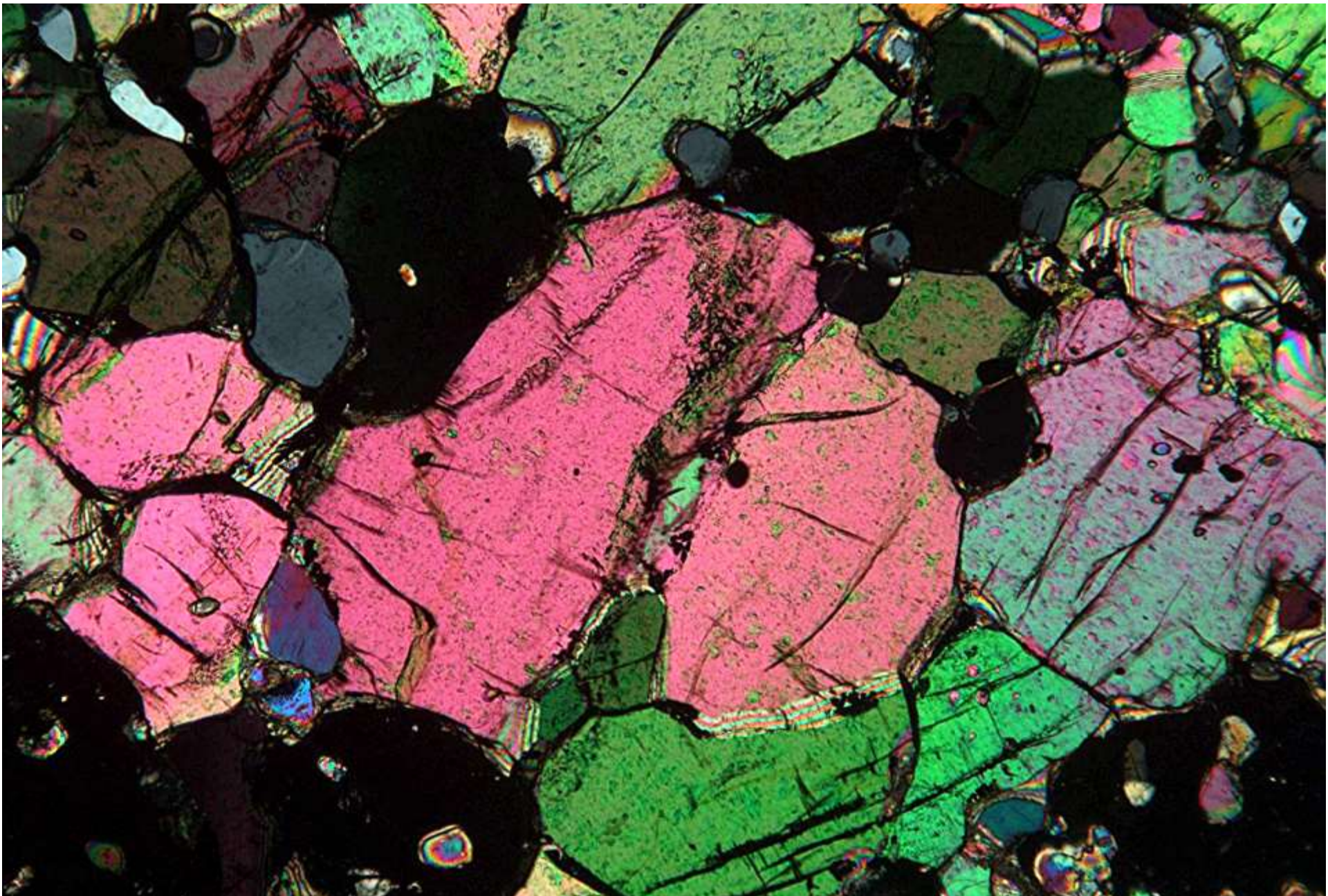
Dolerite. Howford Bridge, Scotland. xpol MP

Olivine (var. fayalite) (yellow) with garnet (pink) and apatite (colourless)



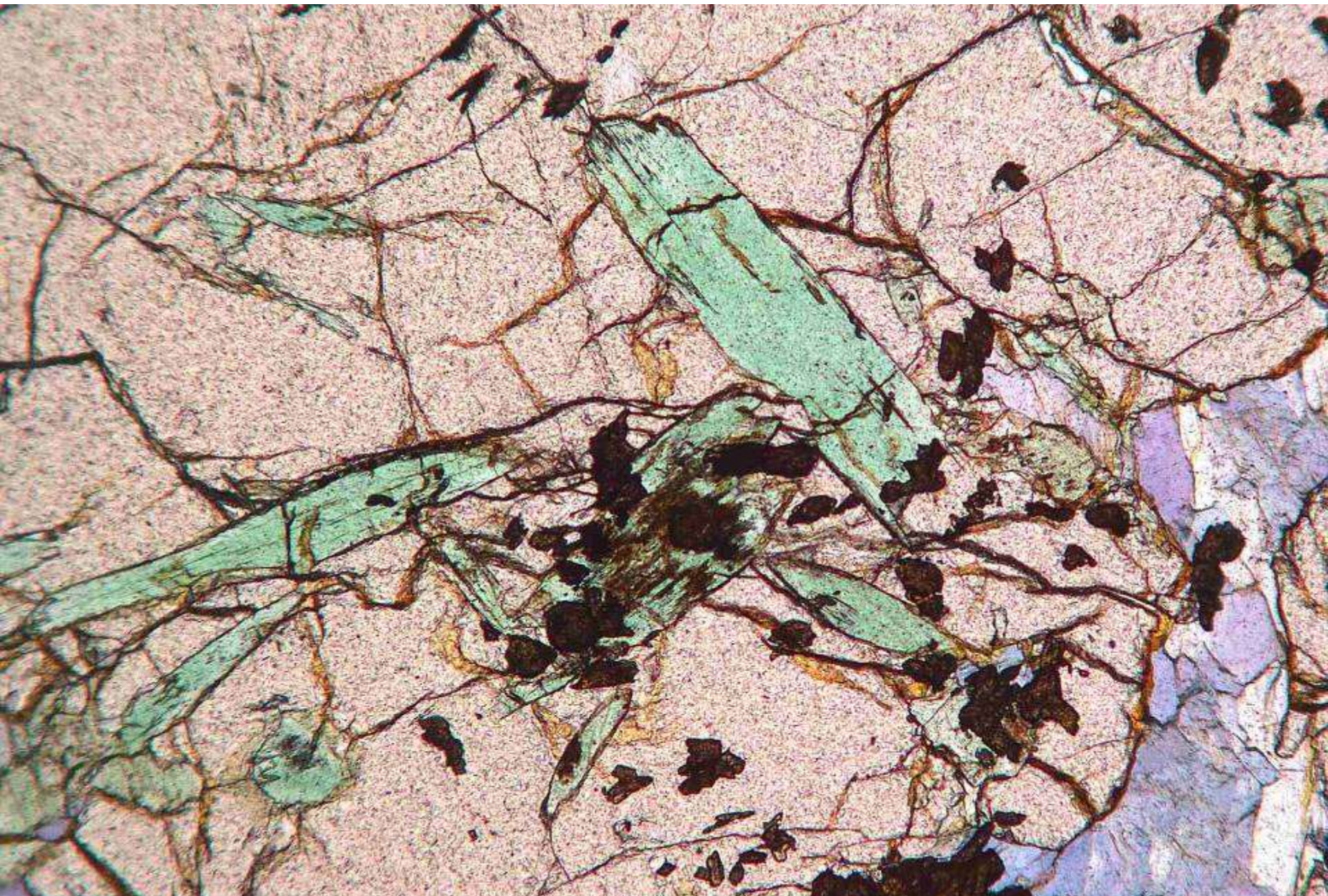
Almandine fayalite granofels. Tunaberg, Sweden. ppl MP

Same view under crossed polars



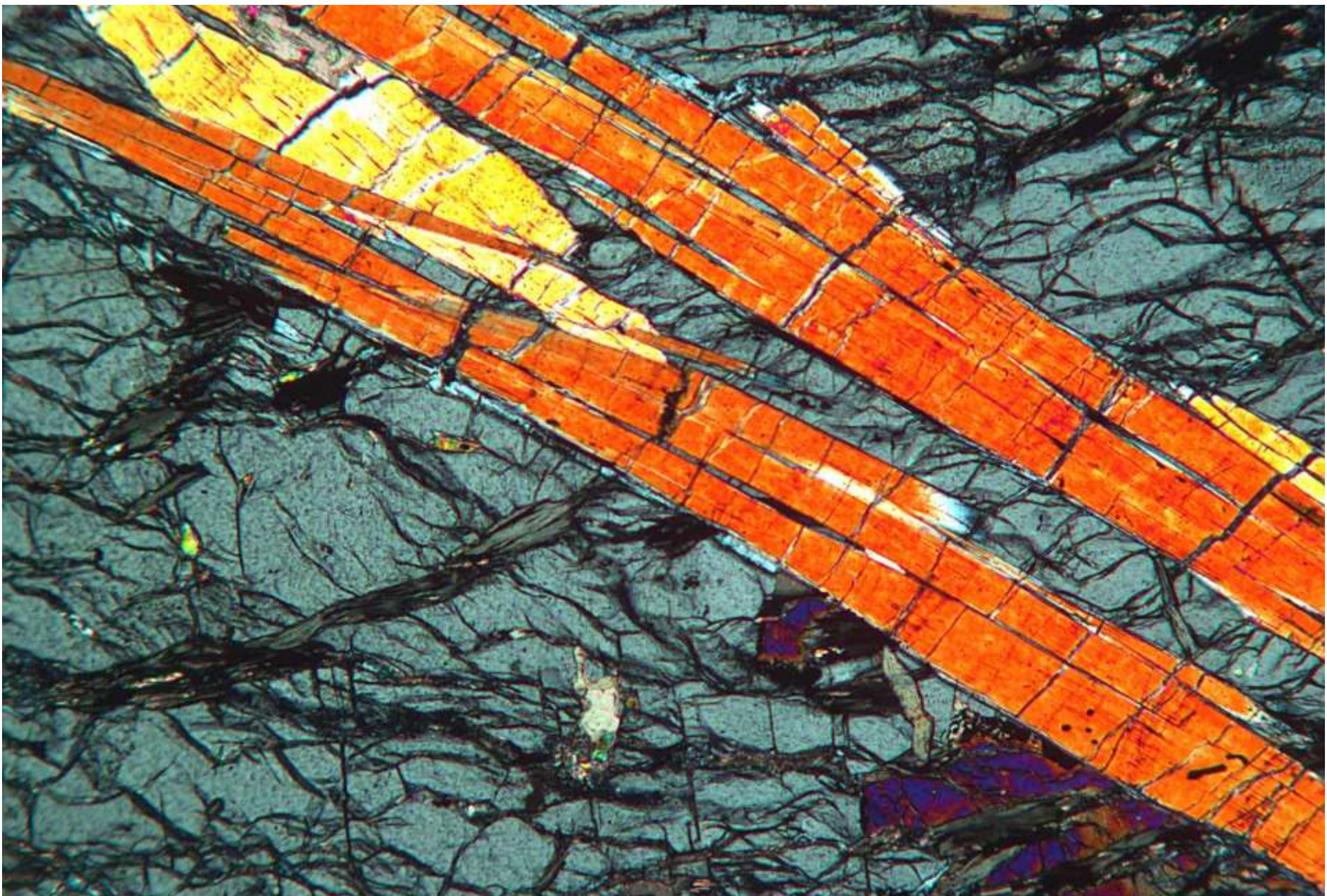
Almandine fayalite granofels. Tunaberg, Sweden. xpol MP

Omphacite inclusions (green) in garnet (pink). Also present: glaucophane and rutile.



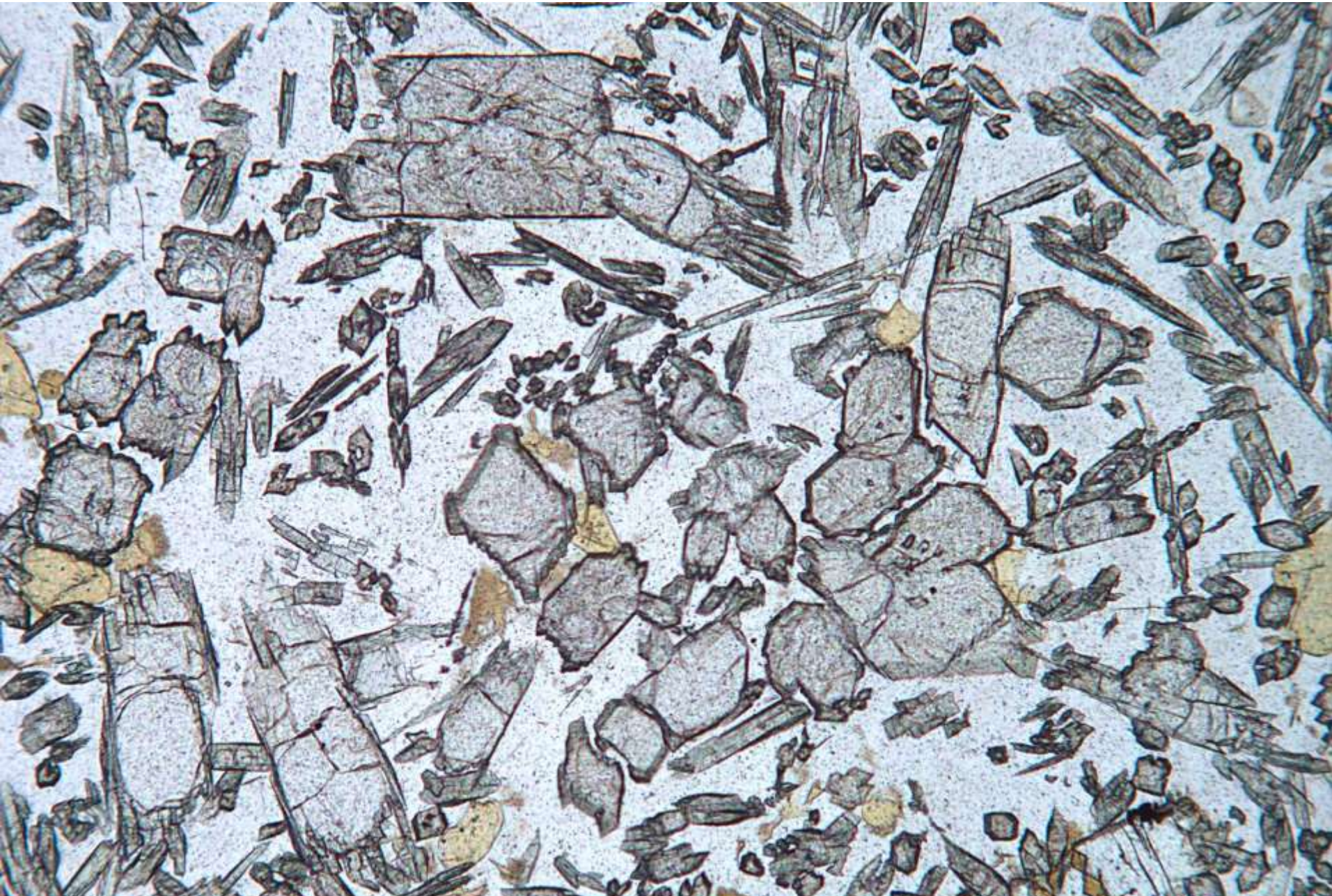
Glaucophane eclogite. Syros, Greece. ppl MP

Anthophyllite prisms (yellow & orange interference colours) in olivine



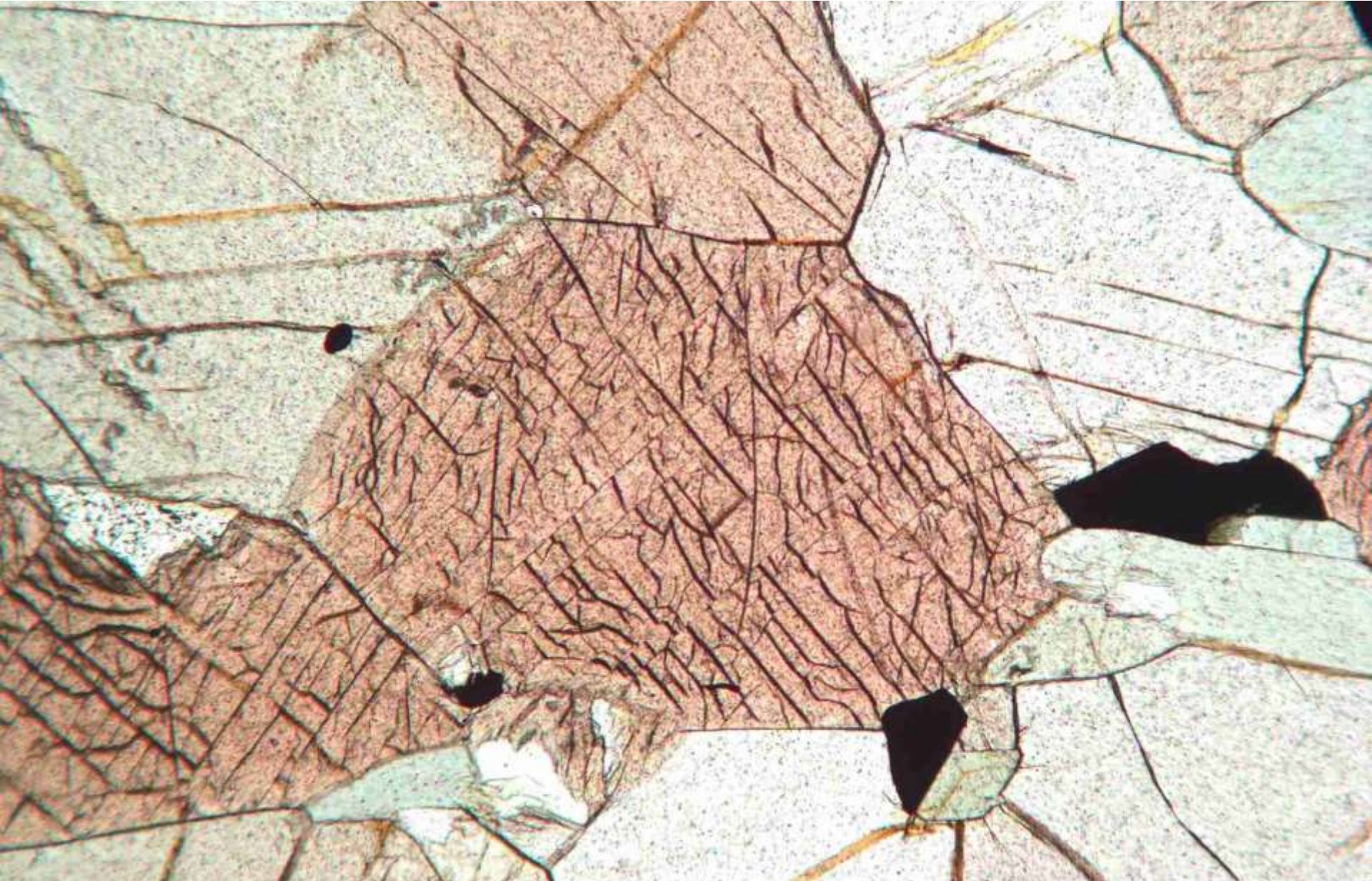
Forsterite anthophyllite granofels. Harris, Scotland. xpol MP

Orthopyroxene (var. enstatite) crystals in glass



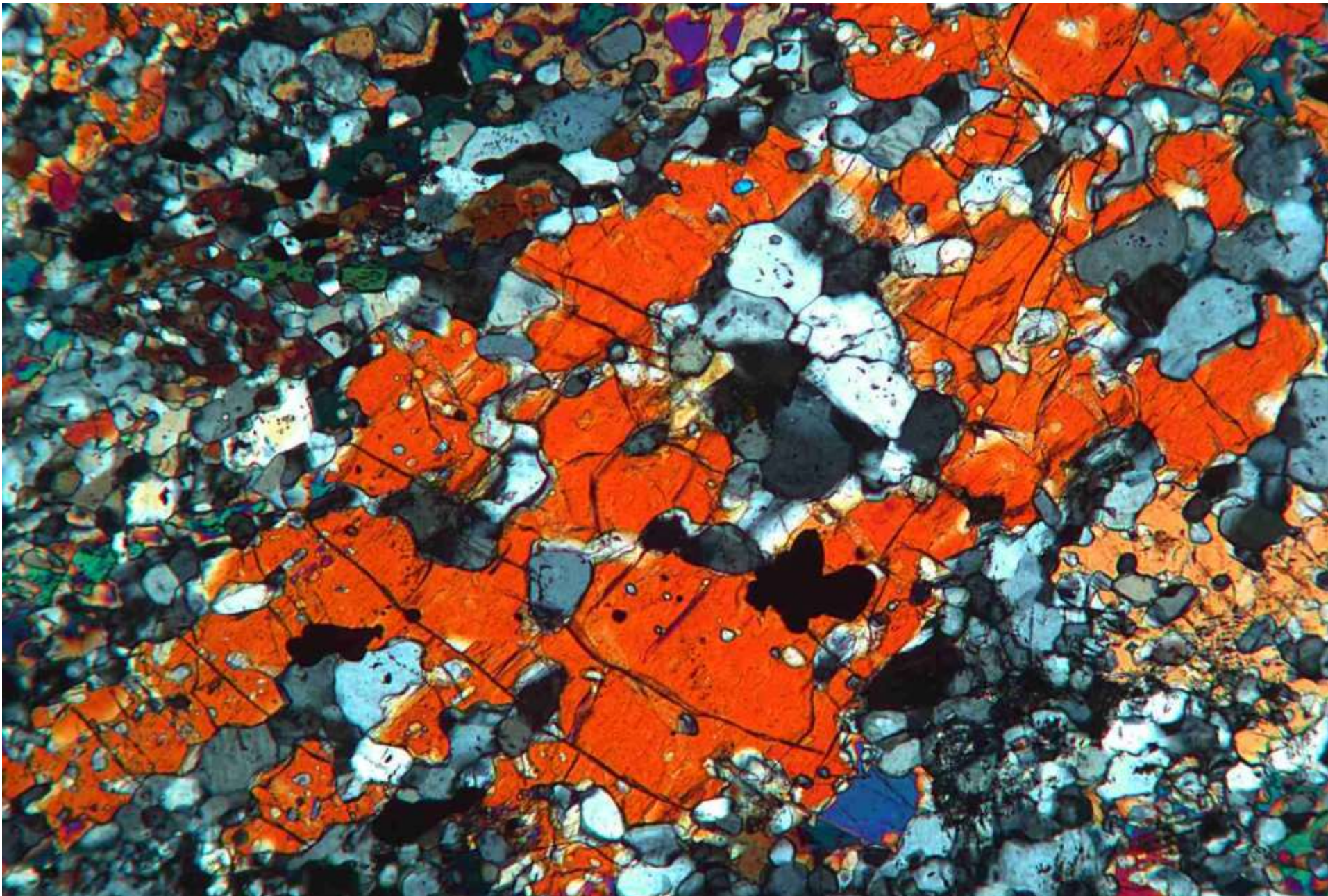
High-Mg andesite ('boninite'). Chichi Jima, Bonin Islands, Japan. ppl MP

Orthopyroxene (var. hypersthene) in various orientations, showing pleochroism and cleavage, with spinel (very dark) and hornblende (pale green)



Orthopyroxenite. Beitbridge, Zimbabwe. ppl MP

Orthopyroxene (orange interference colour) with fine-grained augite and plagioclase



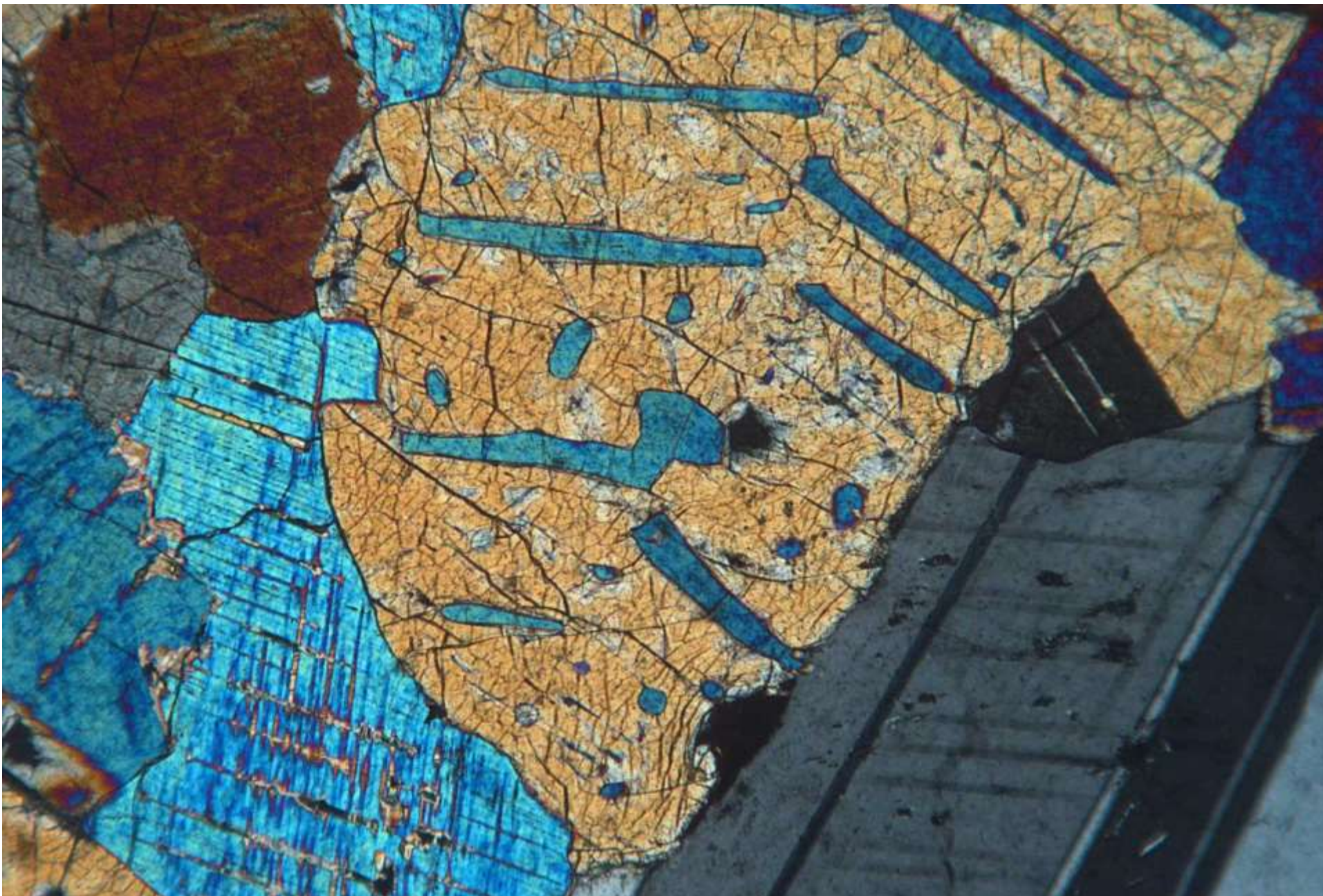
Pyroxene plagioclase hornfels. Lochawe, Scotland. xpol MP

Orthopyroxene (inverted pigeonite) with 'herringbone' exsolution lamellae of augite.
Also present: augite (left) and plagioclase (lower right)



Gabbro. Locality unknown. ppl MP

Same view under crossed polars



Gabbro. Locality unknown. xpol MP

Piemontite crystals in quartz



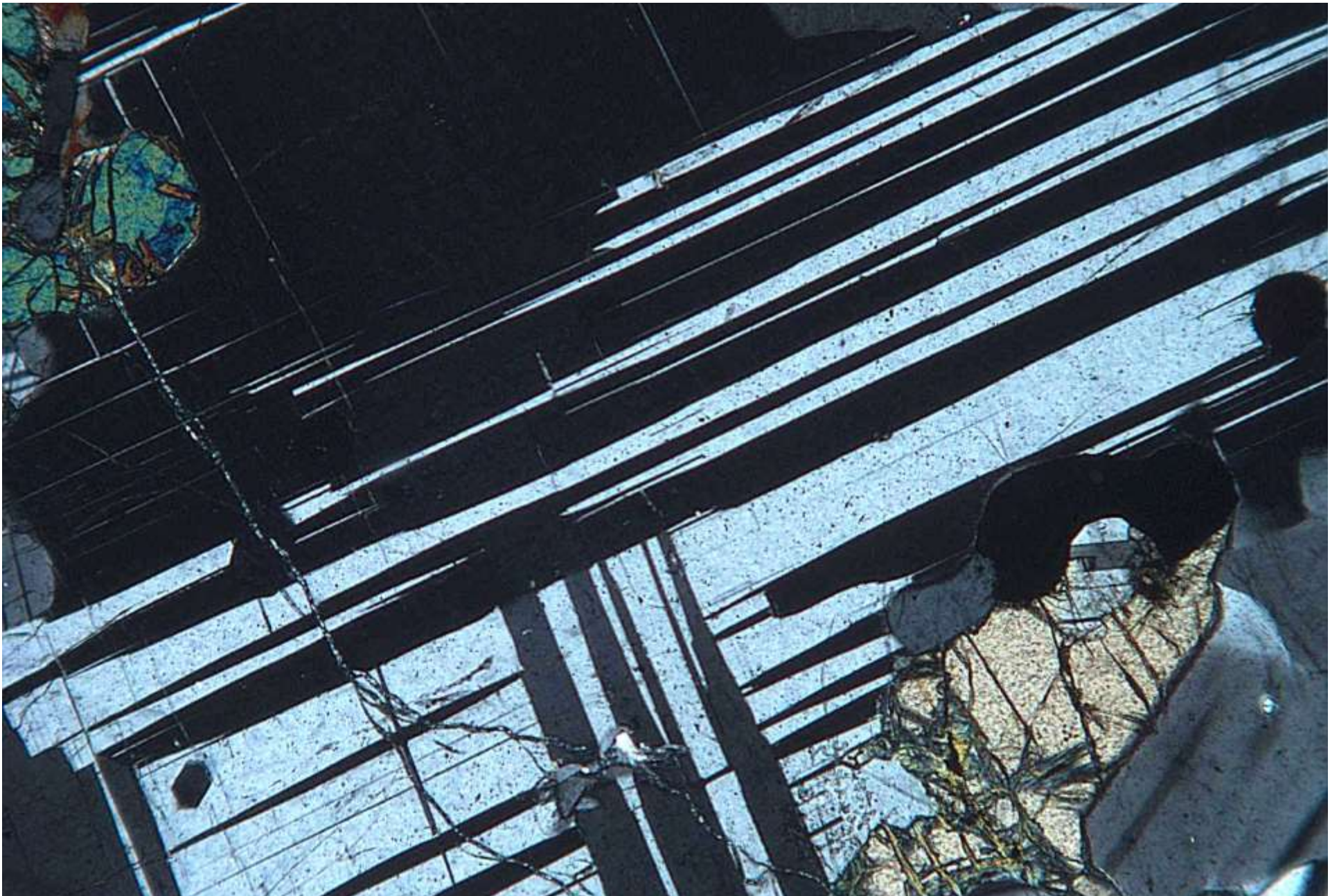
Piemontite quartzite. Praborna, St Marcel, N. Italy. ppl MP

Plagioclase crystals, with multiple twinning, with augite and olivine



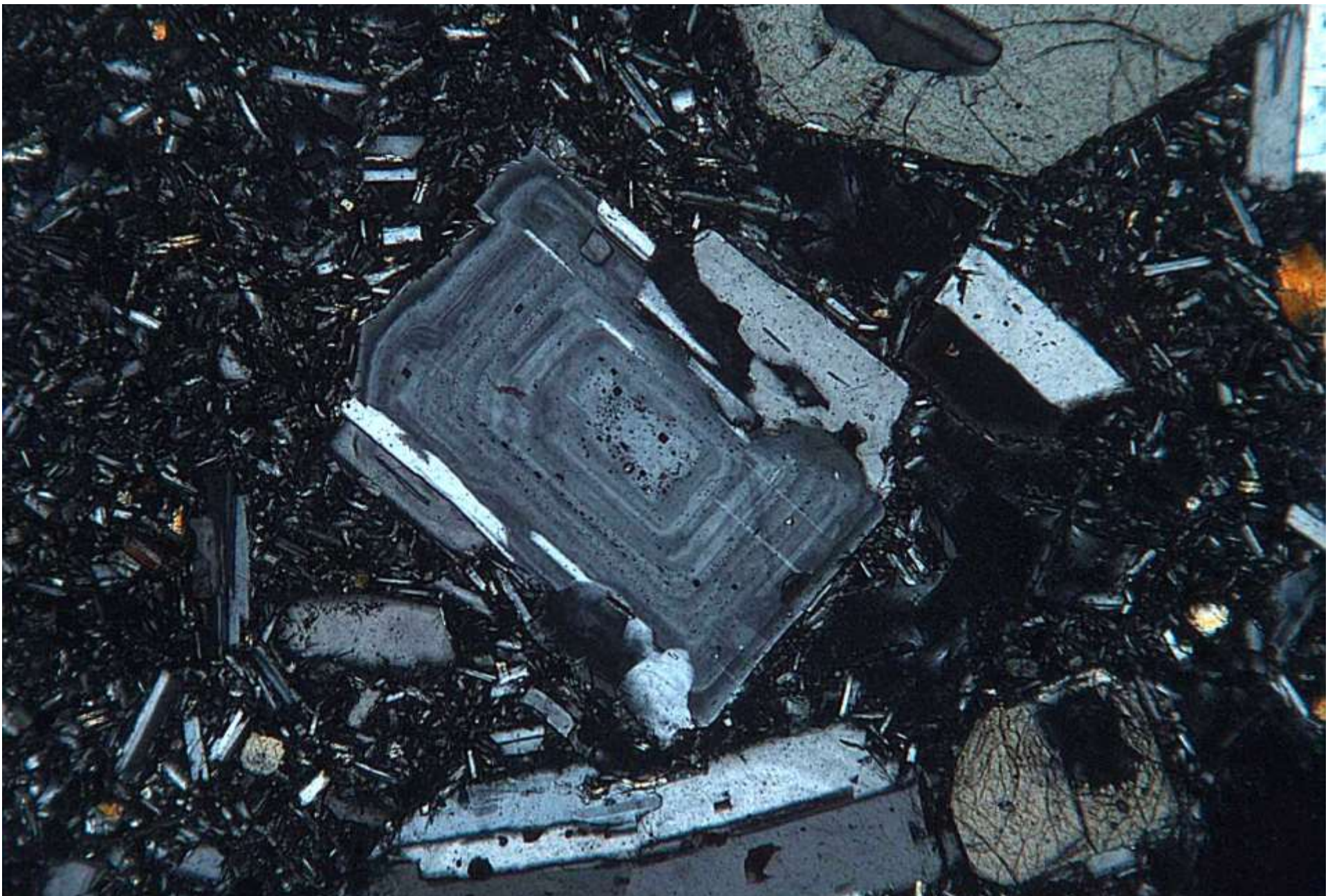
Olivine gabbro. Madeira. xpol LP

Plagioclase crystal showing multiple twinning in two directions. Also present: olivine



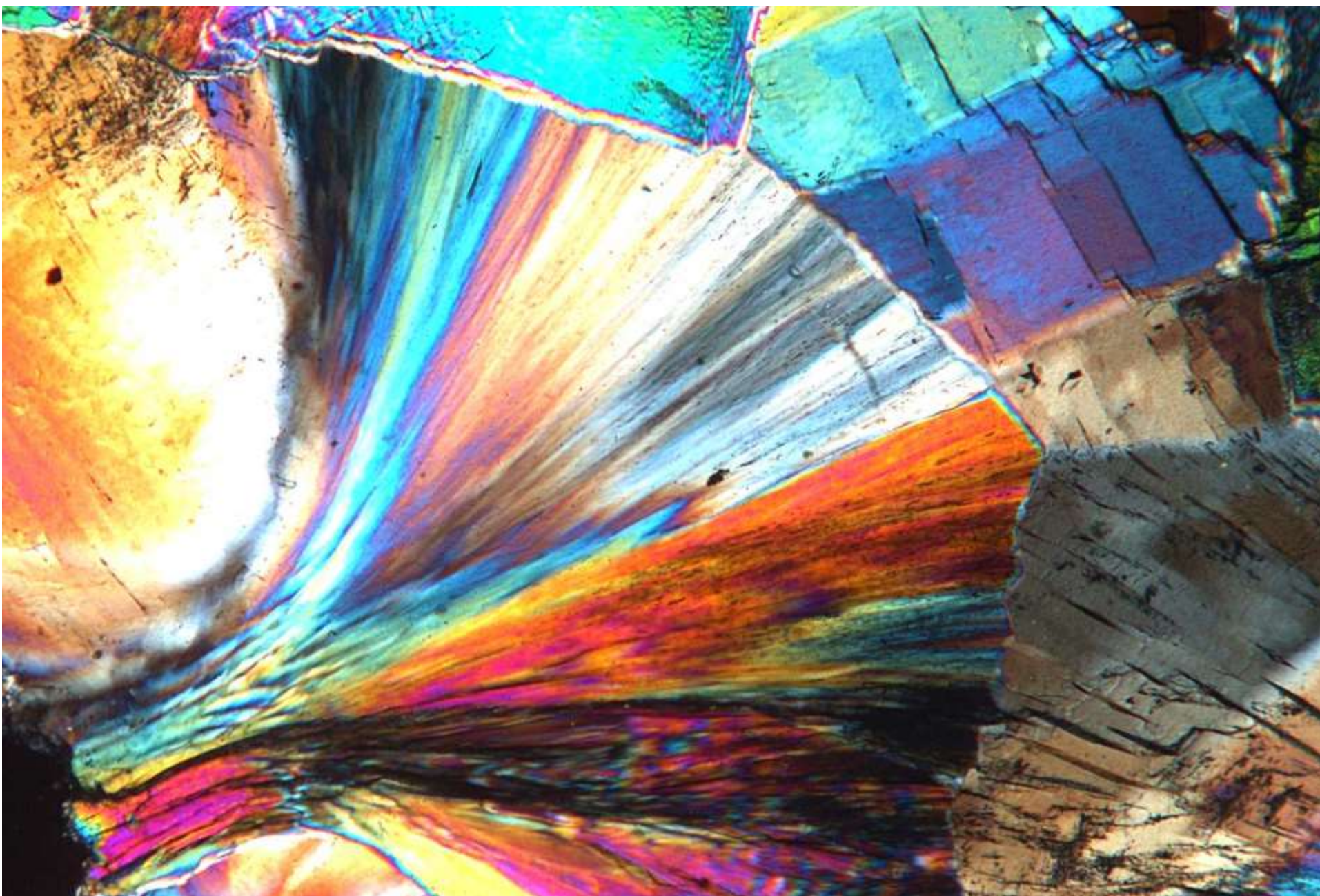
Olivine gabbro. Inch, Scotland. xpol MP

Plagioclase crystal with oscillatory zoning in glass. Also present: pyroxene(s)



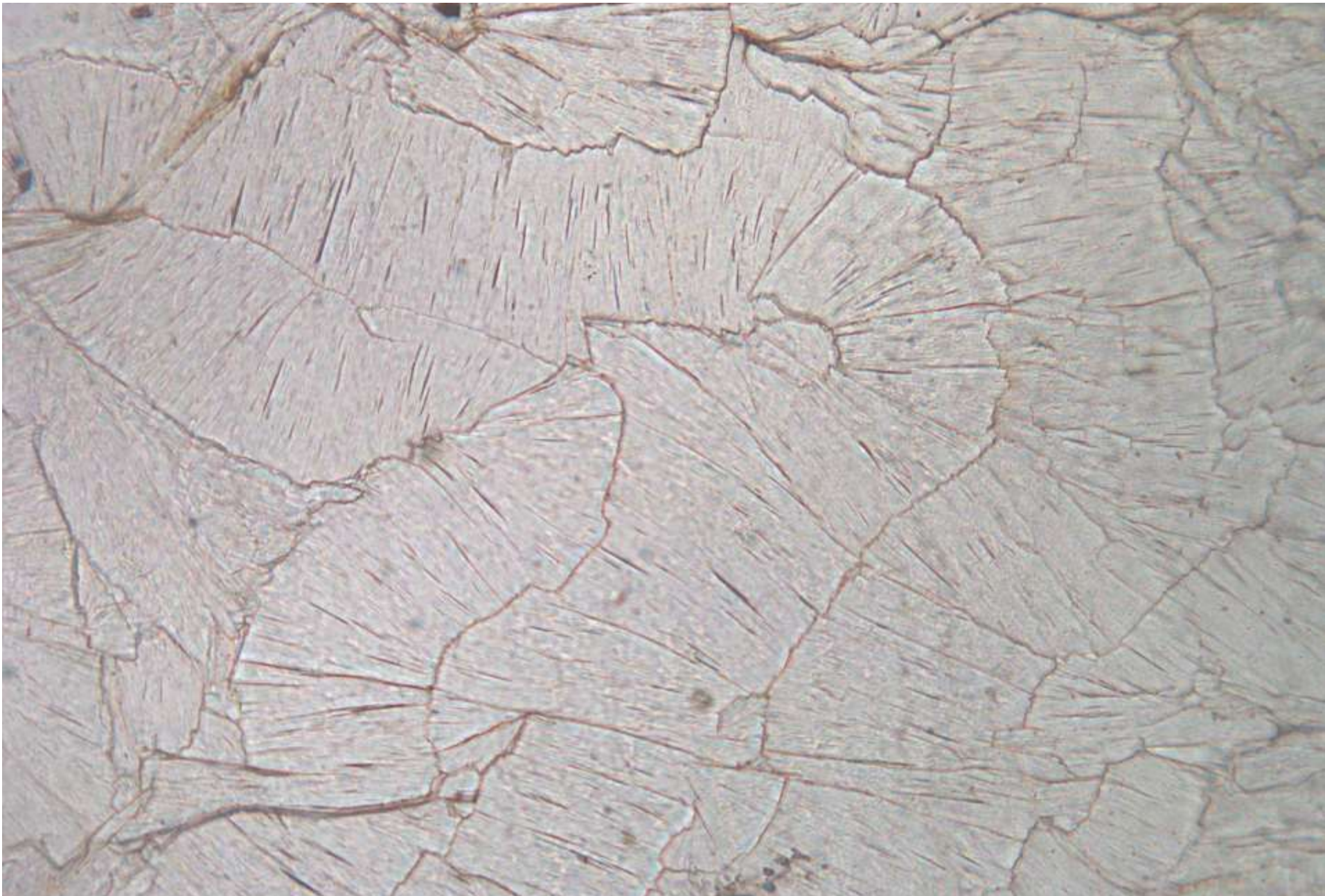
Andesite. Asama, Japan. xpol MP

Prehnite with characteristic 'bow-tie' texture



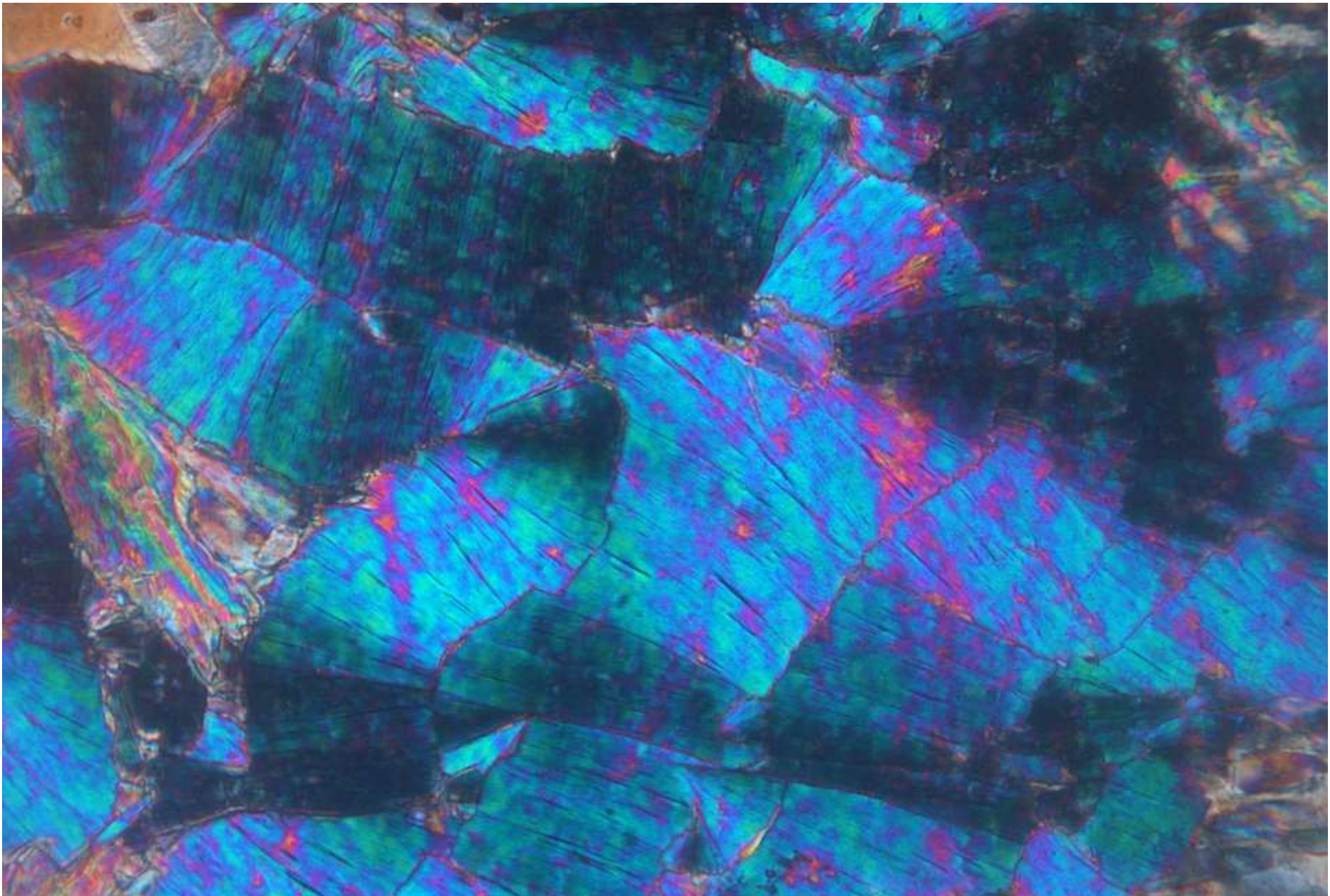
Calc-silicate rock. Locality unknown. xpol MP

Vermiform stacks of pyrophyllite crystals



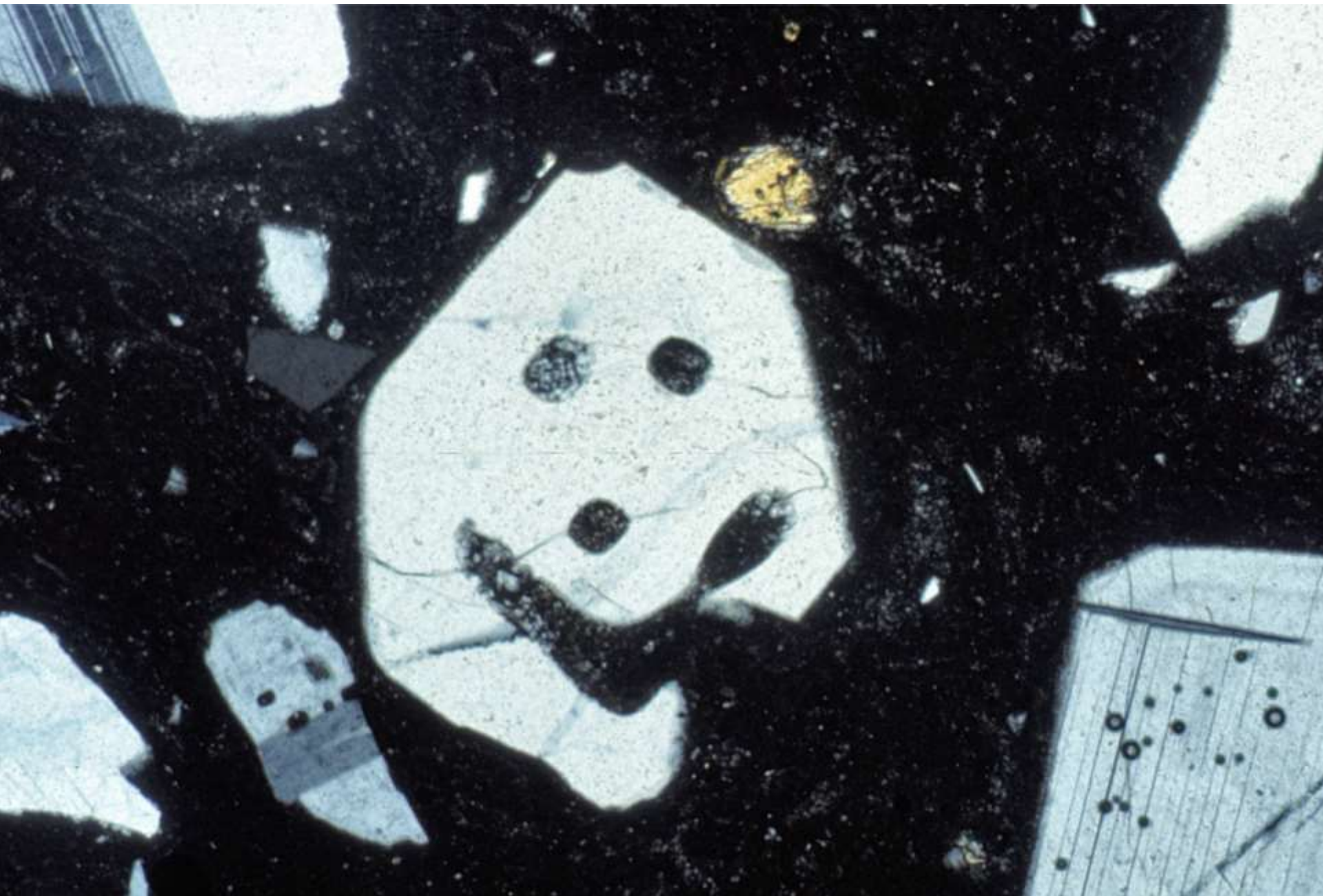
Pyrophyllite rock. Locality unknown. ppl HP

Same view under crossed polars



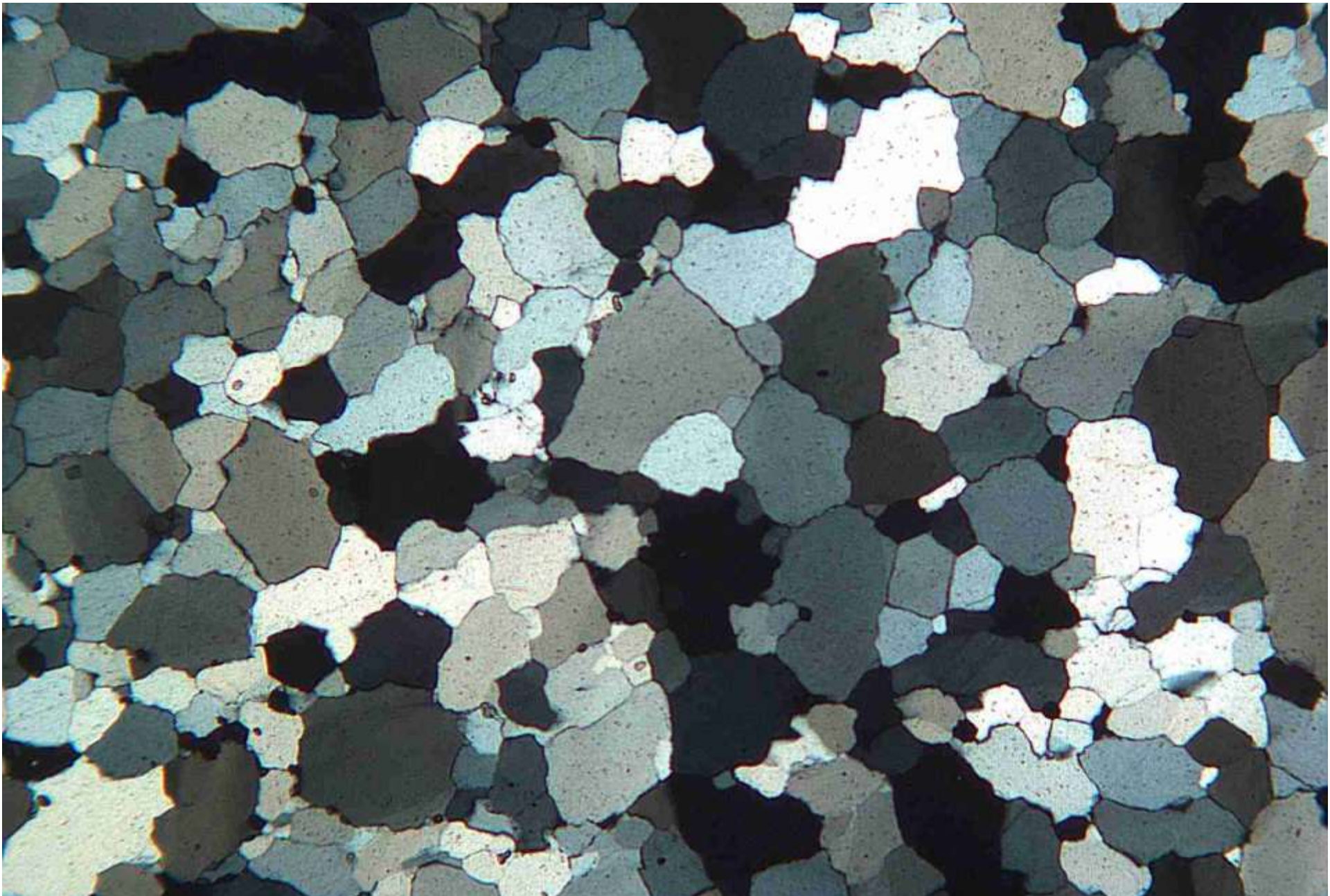
Pyrophyllite rock. Locality unknown. xpol HP

A partially resorbed quartz phenocryst: it seems to have enjoyed the process!



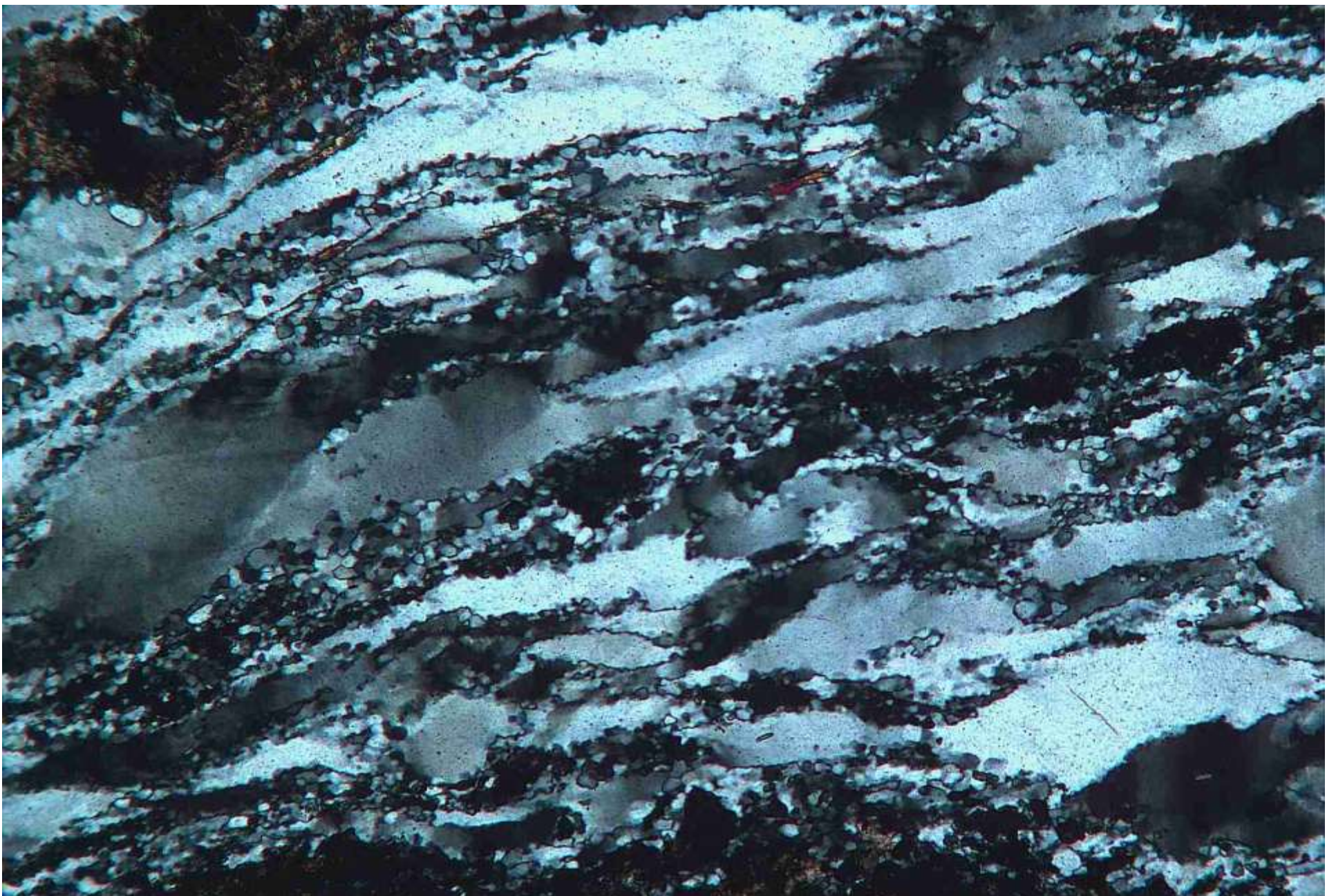
Rhyolite. Locality unknown. xpol MP

Quartz aggregate with granoblastic texture



Aegirine quartzite. Cervinia, N Italy. xpol LP

Quartz showing high-strain intracrystalline deformation & dynamic recrystallisation



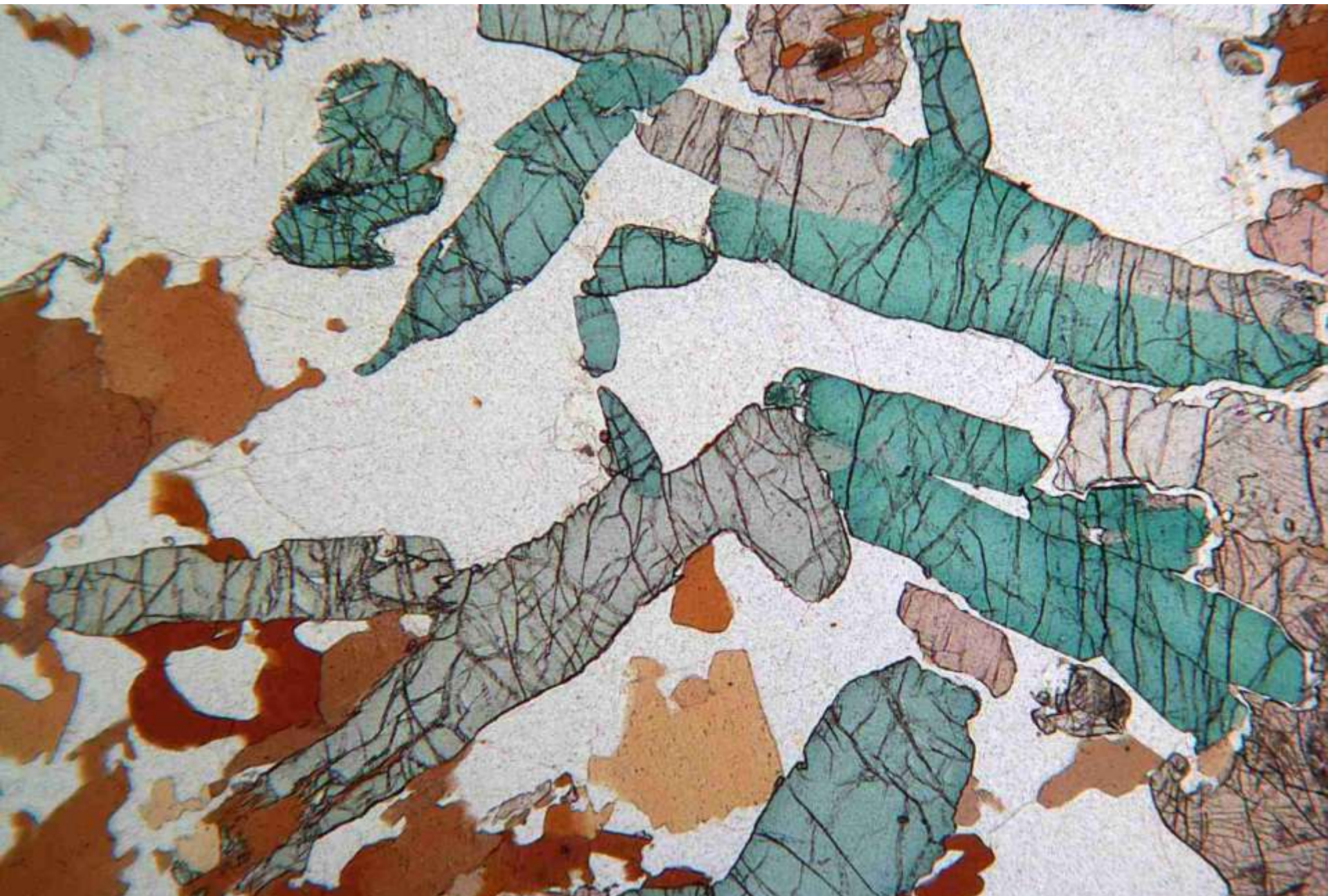
Mylonite. Gairloch, NW Scotland. xpol MP

Euhedral riebeckite cross-section with thin glaucophane rim.
Also present: garnet (var. spessartine - tiny equant xls), phengite (green) and quartz



Riebeckite spessartine quartzite. Laytonville, California, USA. ppl MP

Sapphirine (blue) with cordierite (colourless), biotite (brown) and orthopyroxene (pink)



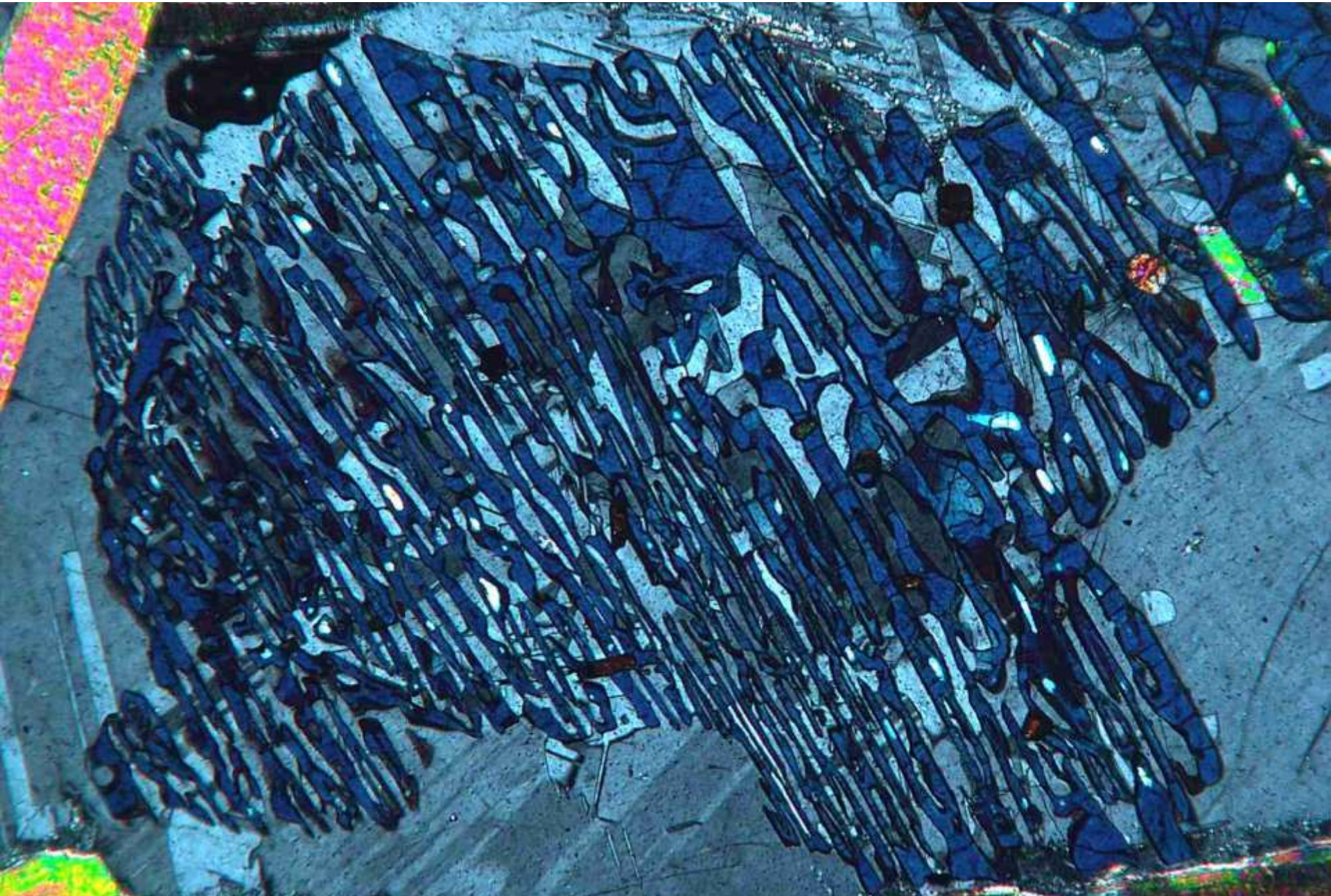
Garnet opx cordierite sapphirine granofels. Val Codera, N Italy. ppl LP

Sapphirine (blue) intergrown with cordierite. Also present: biotite



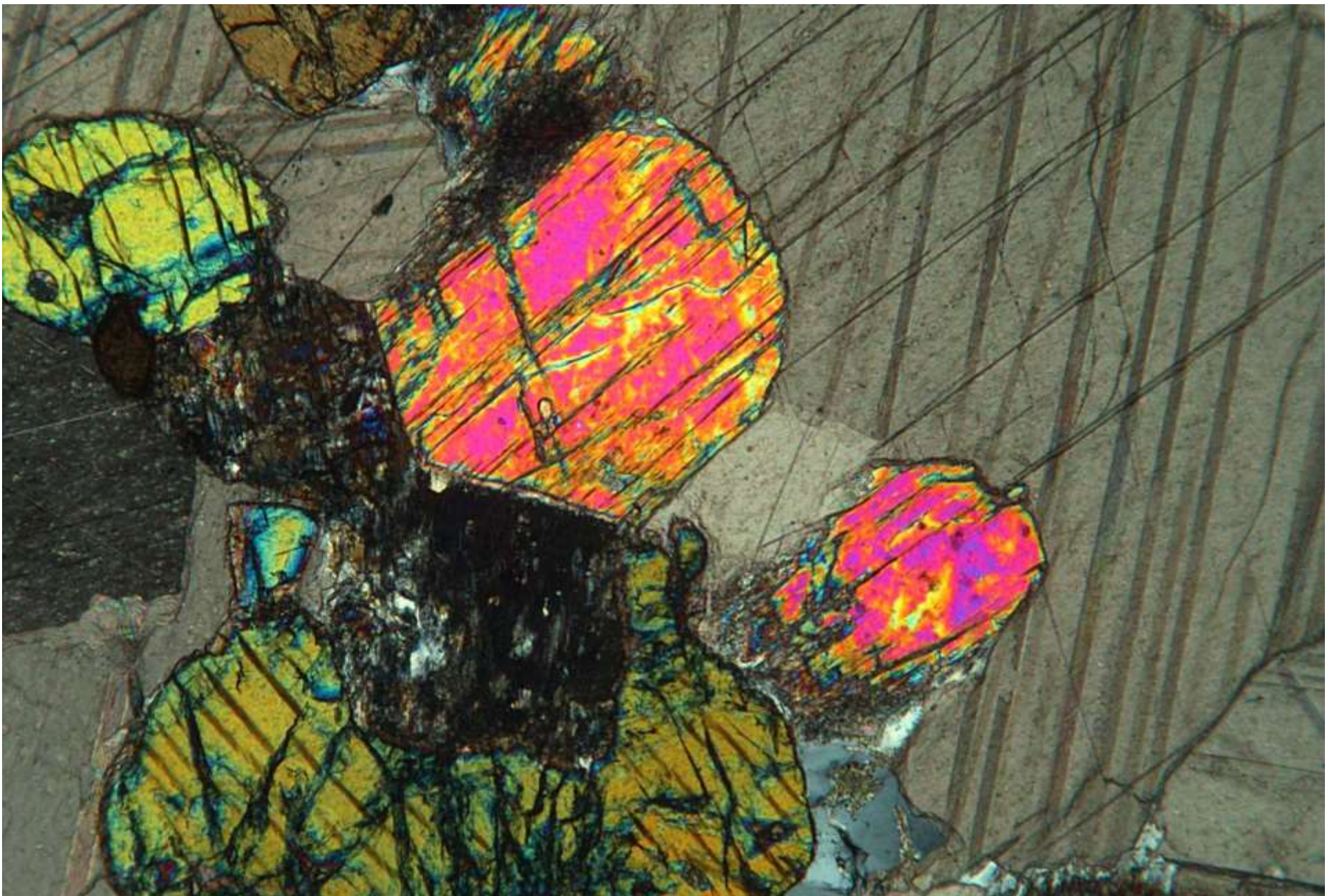
Cordierite sapphirine granofels. Europe Claim, Beitbridge, Zimbabwe. ppl MP

Same view under crossed polars



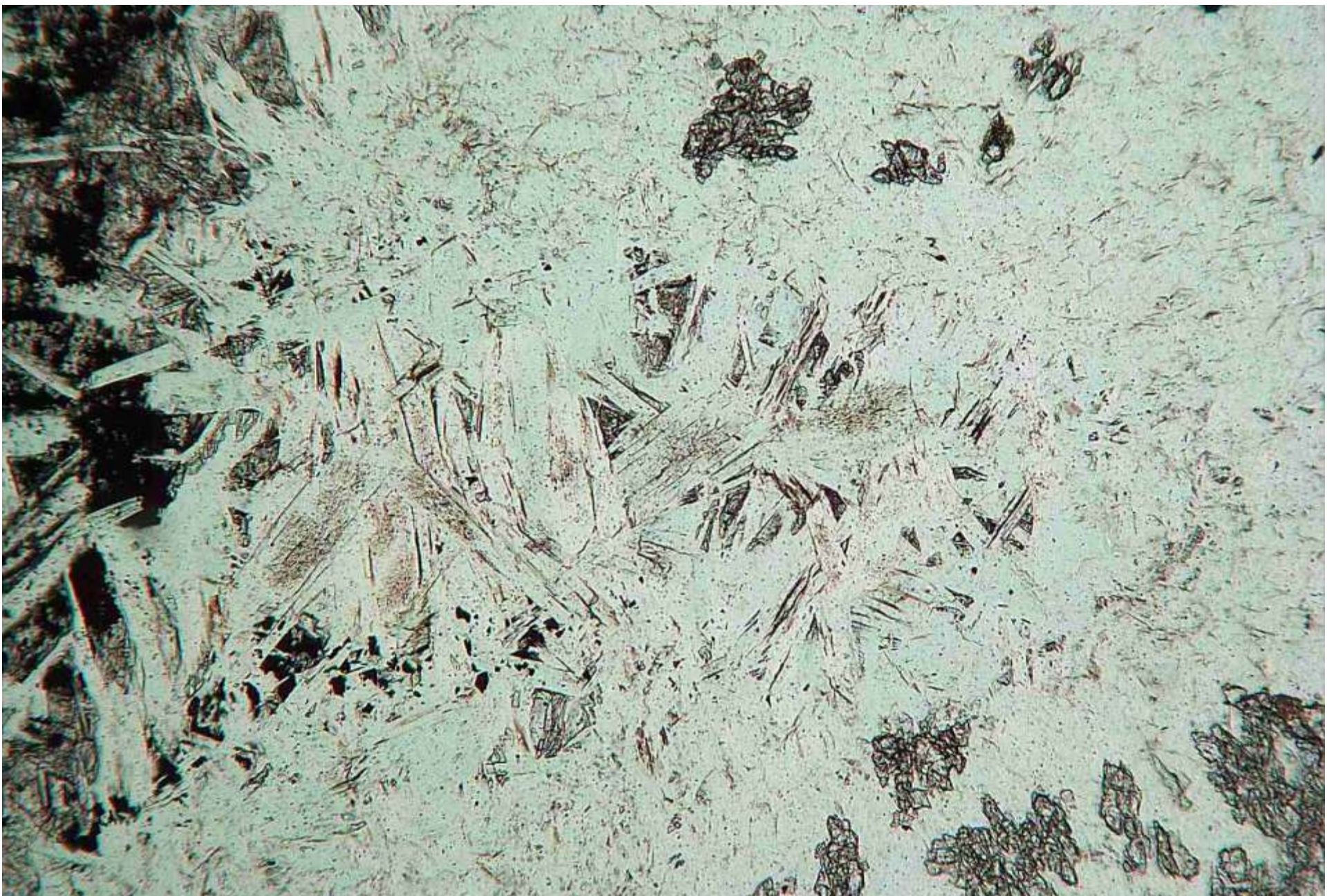
Cordierite sapphirine granofels. Europe Claim, Beitbridge, Zimbabwe. xpol MP

Scapolite (var. meionite) (pink interference colours) with diopside and calcite



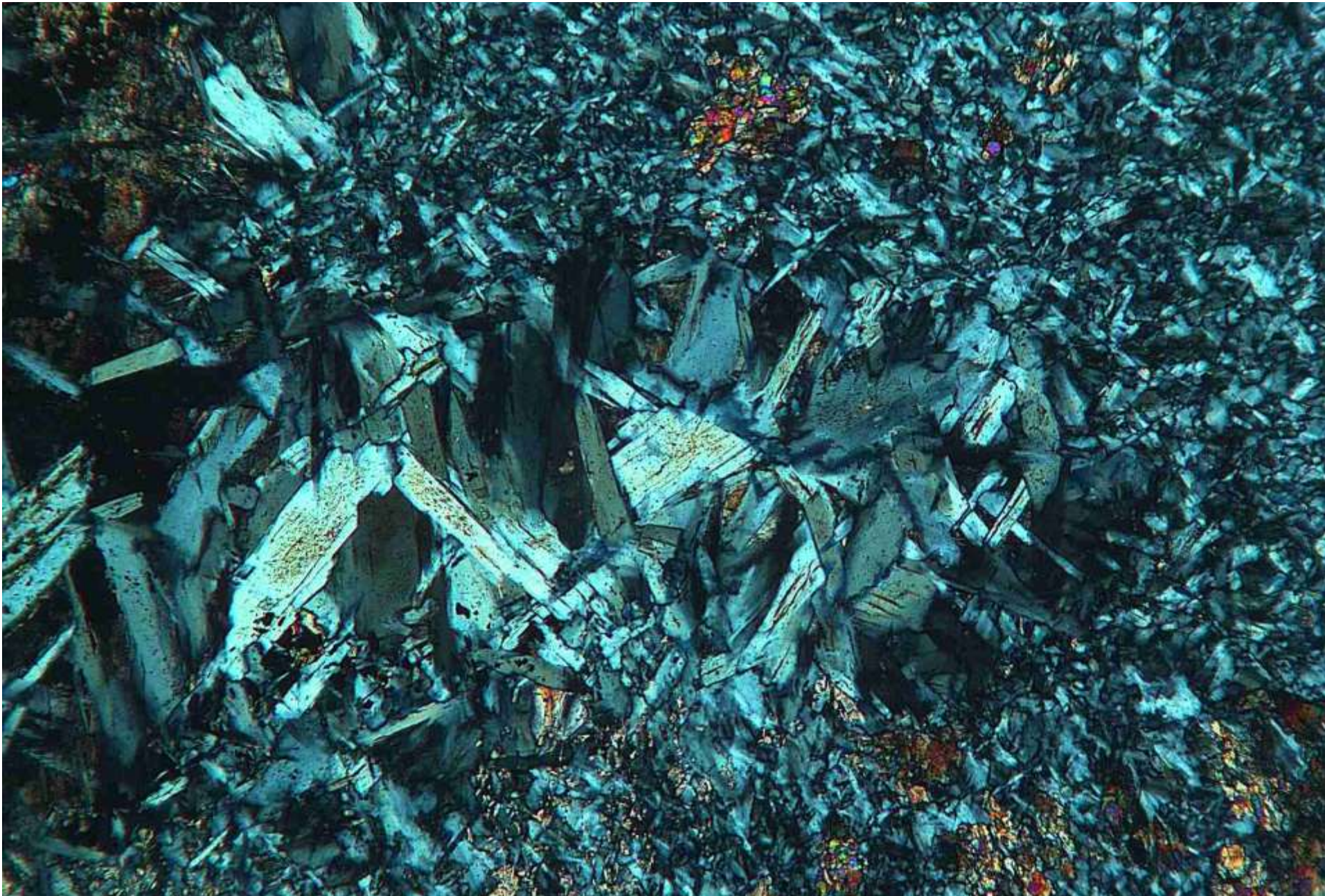
Clinopyroxene scapolite marble. Locality unknown. xpol MP

Serpentine (var. antigorite) with decussate texture. Also present: olivine and opaques



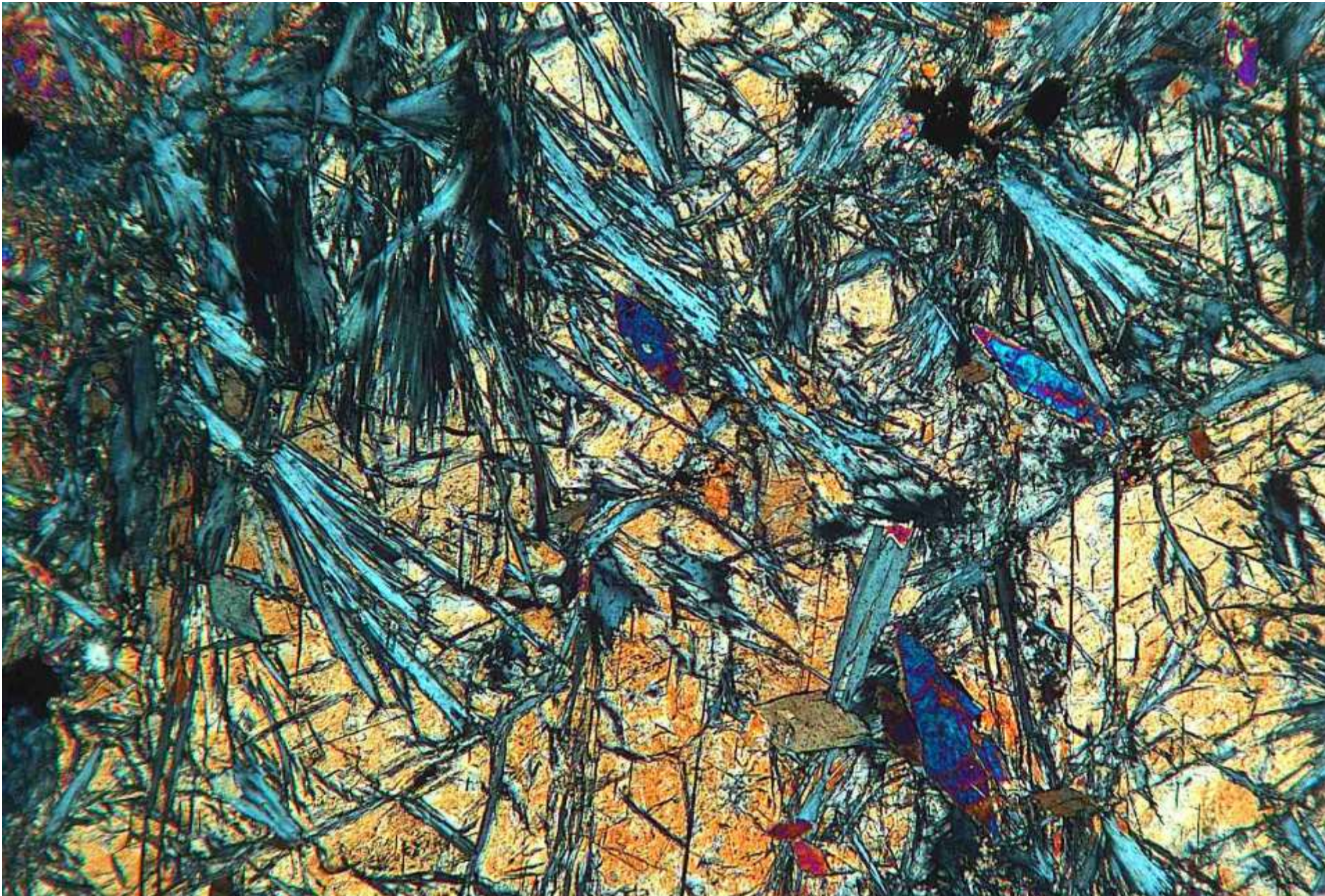
Forsterite serpentinite. Lepontine Alps, Switzerland. ppl MP

Same view under crossed polars



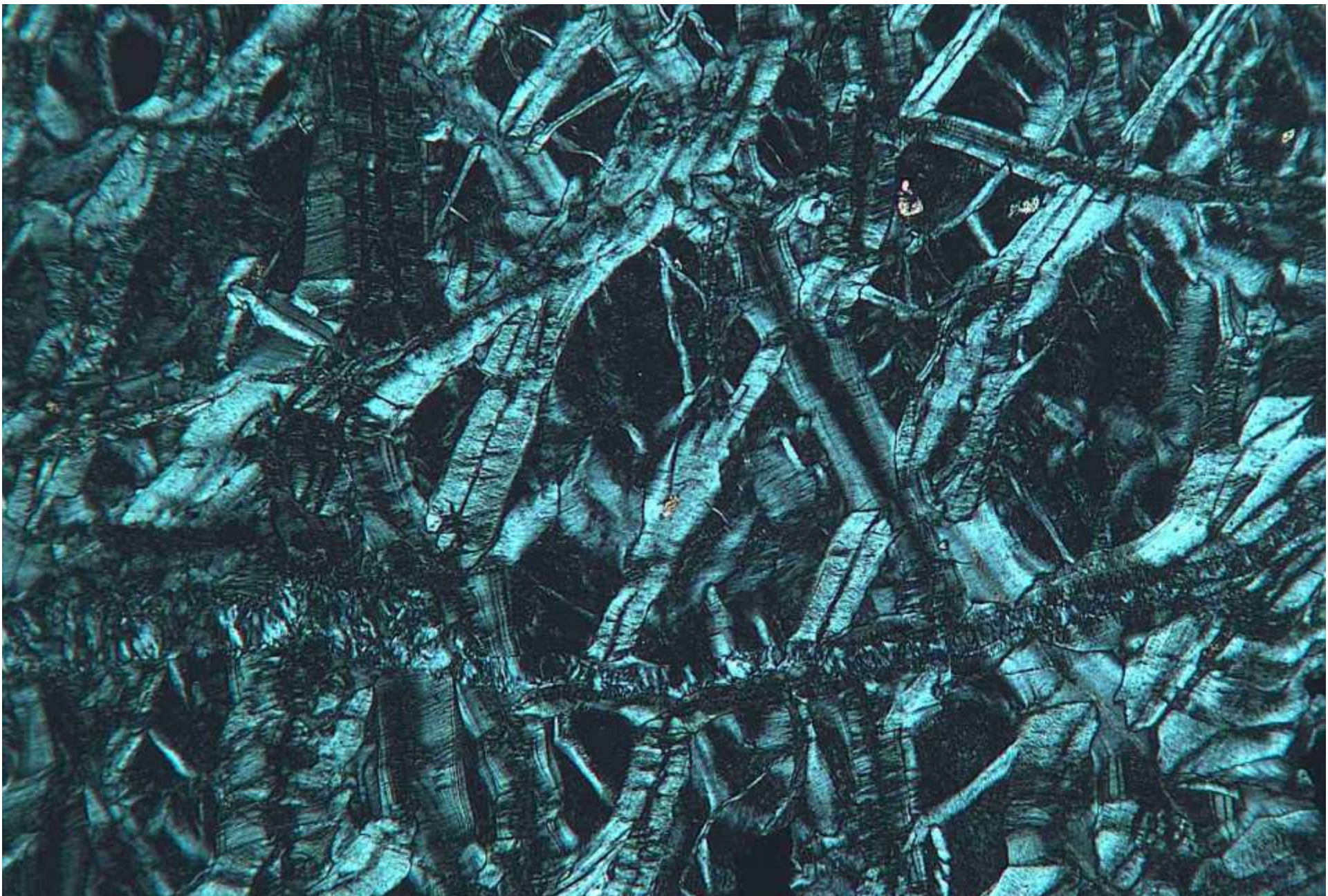
Forsterite serpentinite. Lepontine Alps, Switzerland. xpol MP

Serpentine (var. antigorite) flakes in diopside. Also present: tremolite (blue)



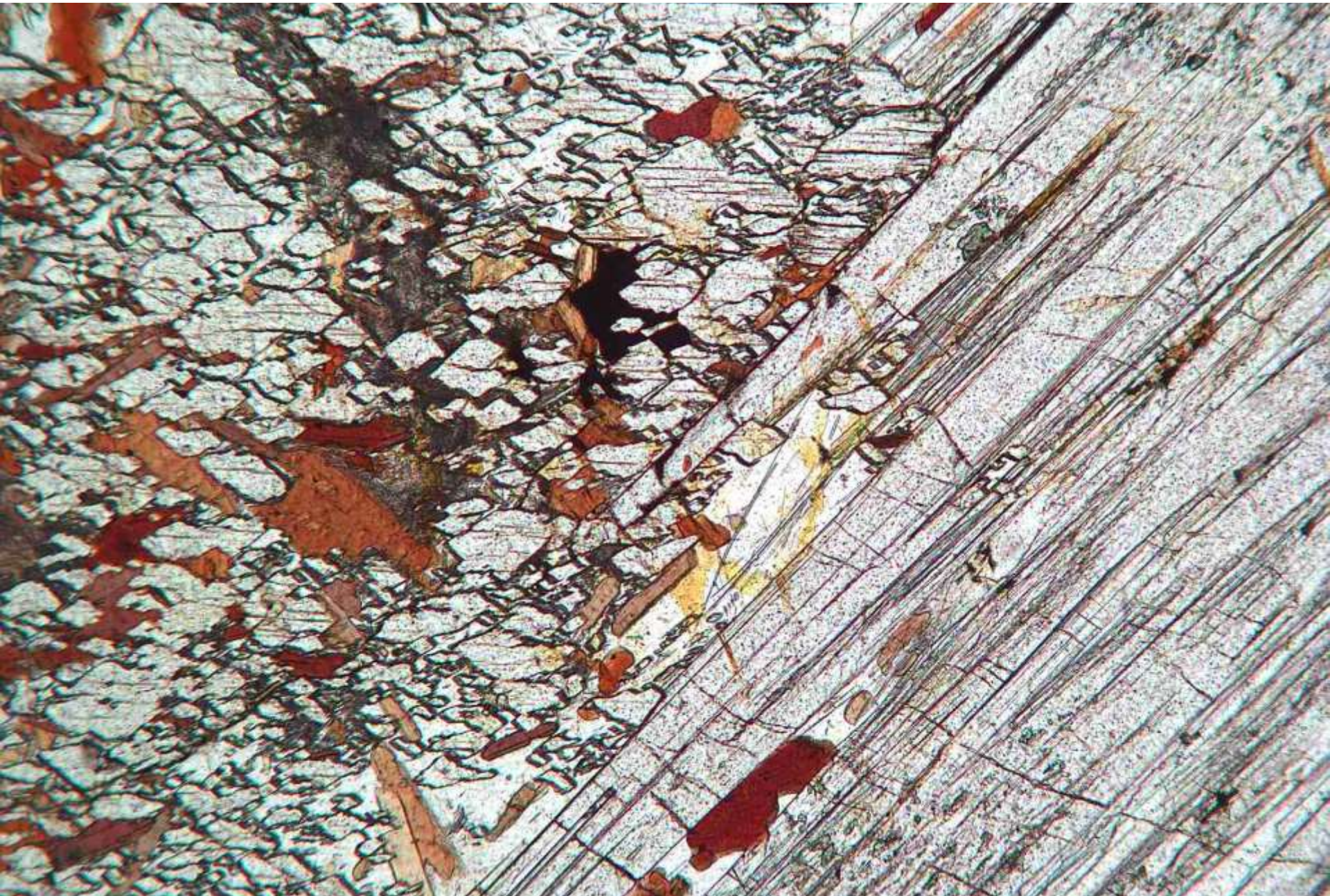
Diopside serpentinite. Val Preda Rossa, N Italy. xpol MP

Serpentine (var. lizardite) showing 'mesh' texture



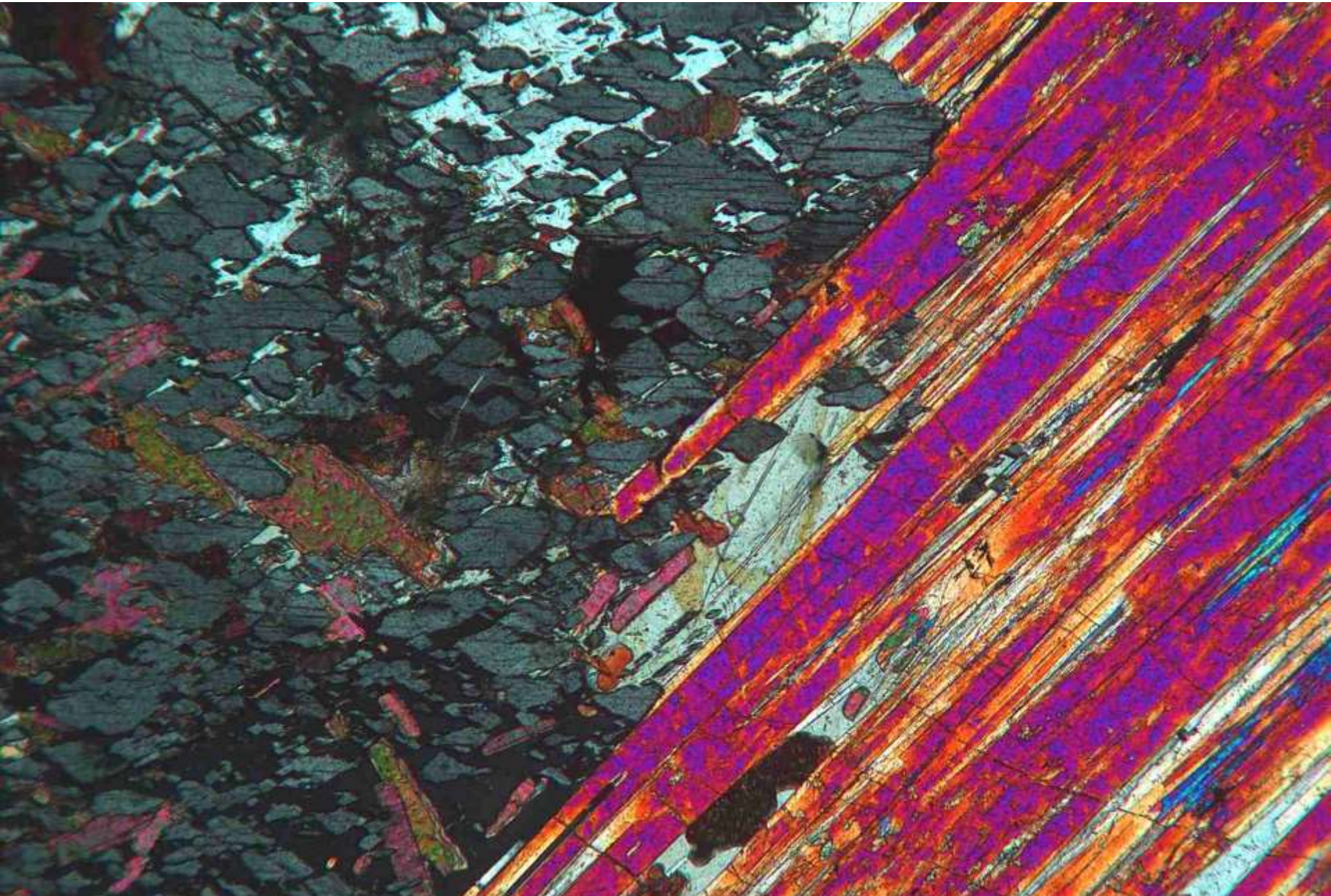
Serpentinite. Lizard, SW England. xpol MP

Clusters of prismatic sillimanite long and cross sections with biotite and plagioclase



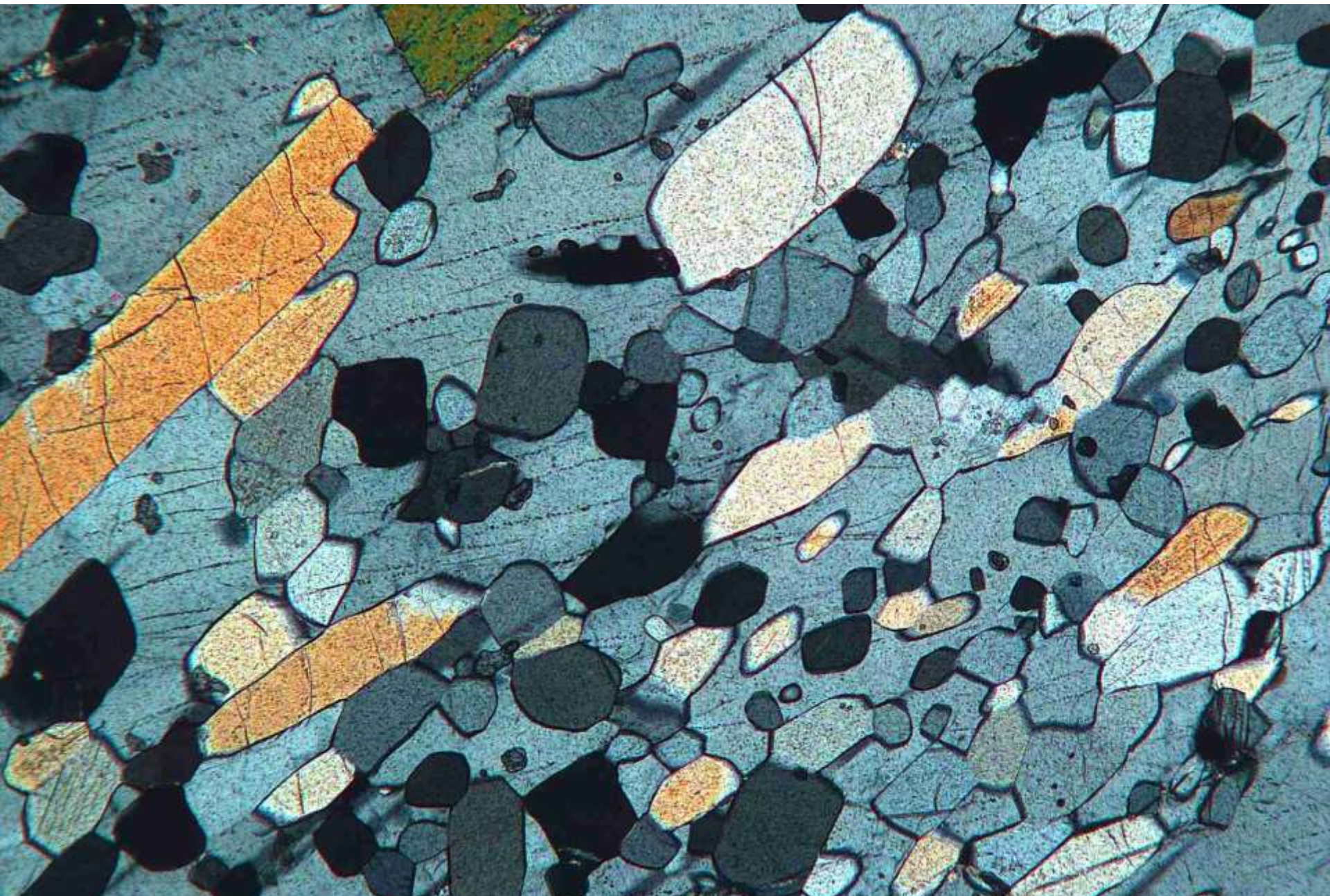
Biotite sillimanite hornfels. Bunessan, Mull, Scotland. ppl MP

Same view under crossed polars



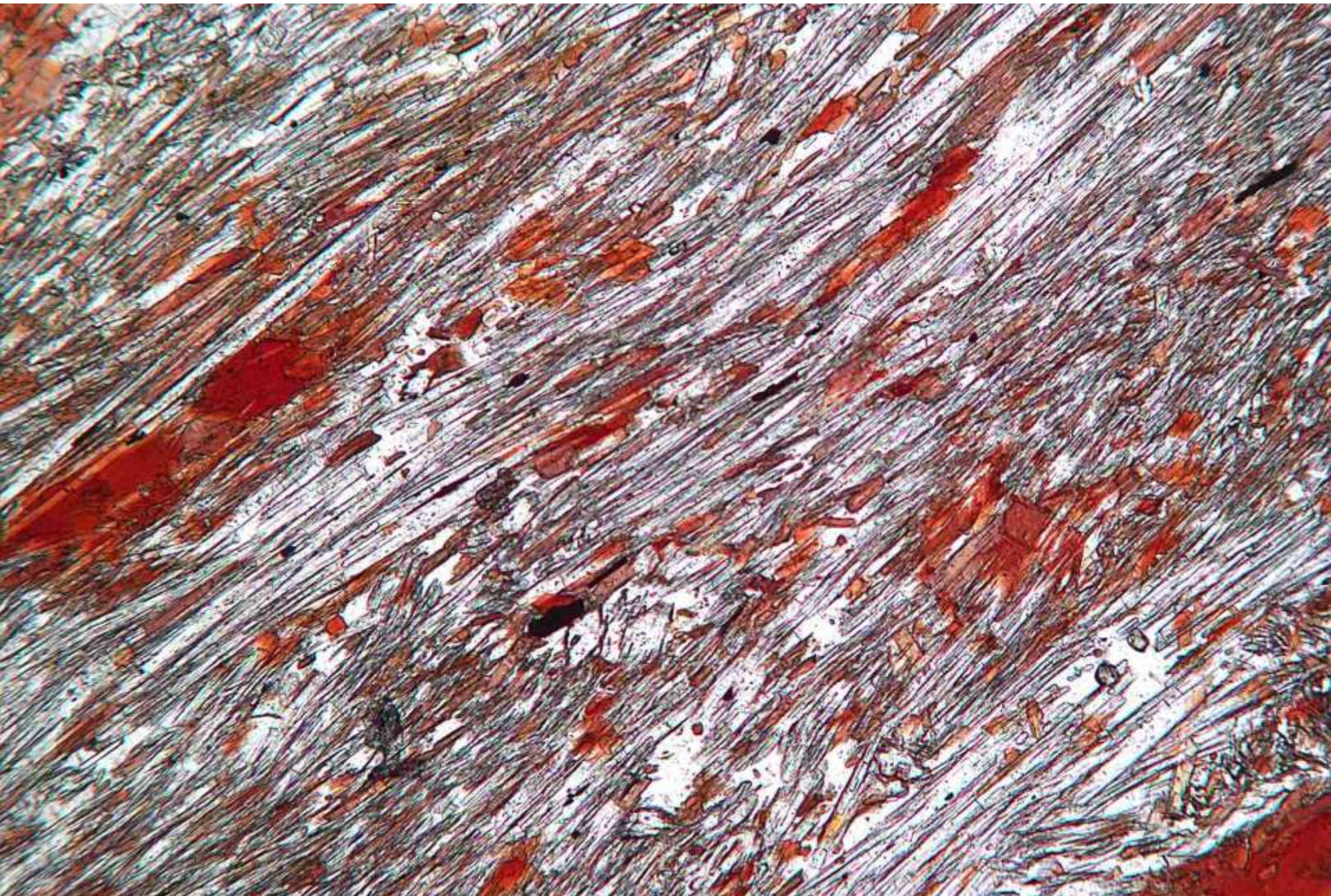
Biotite sillimanite hornfels. Bunessan, Mull, Scotland. xpol MP

Prismatic sillimanite in various orientations with biotite (top) in cordierite



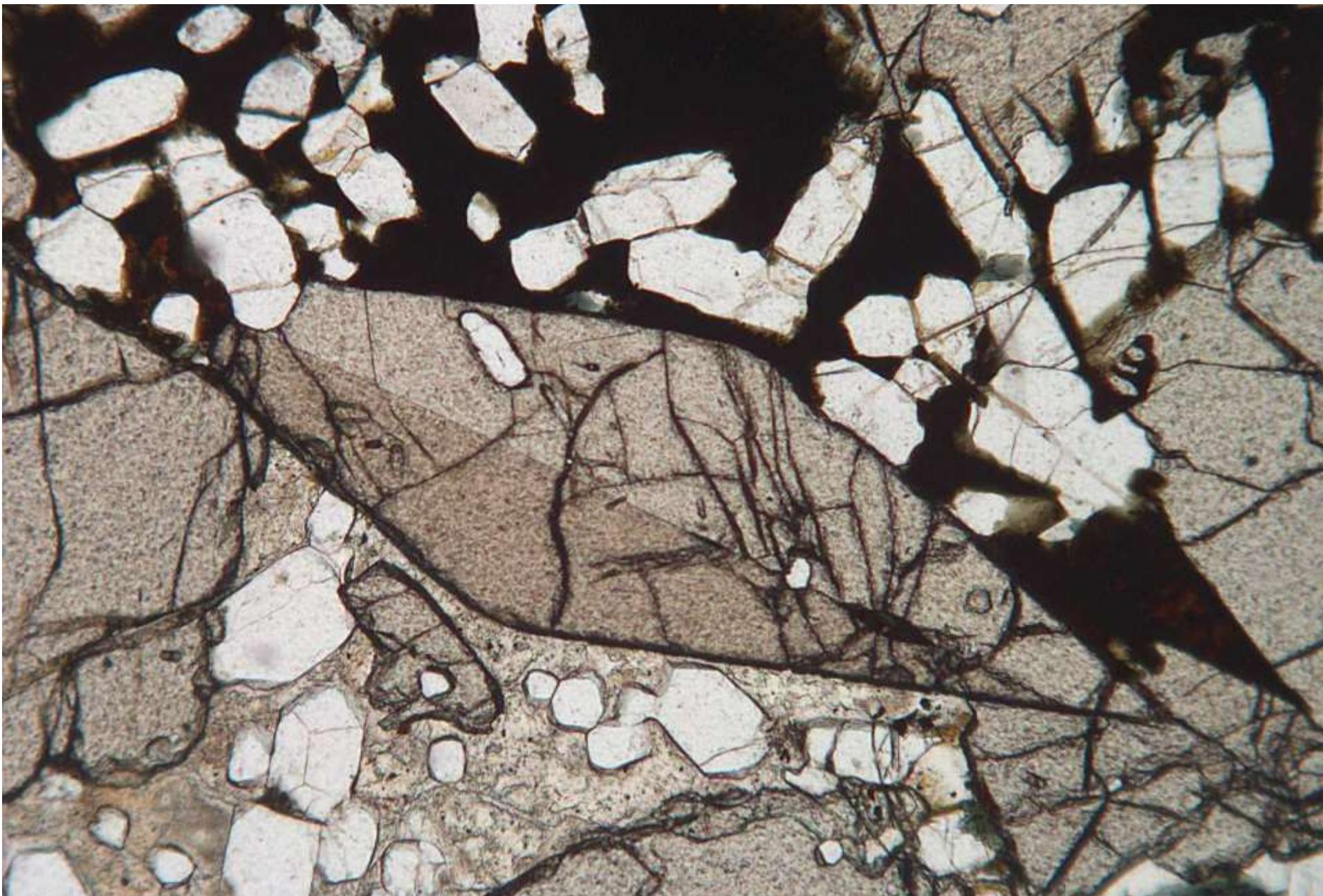
Cordierite sillimanite gneiss. Ihosy, Madagascar. xpol MP

Acicular sillimanite, mainly long sections, with biotite and cordierite



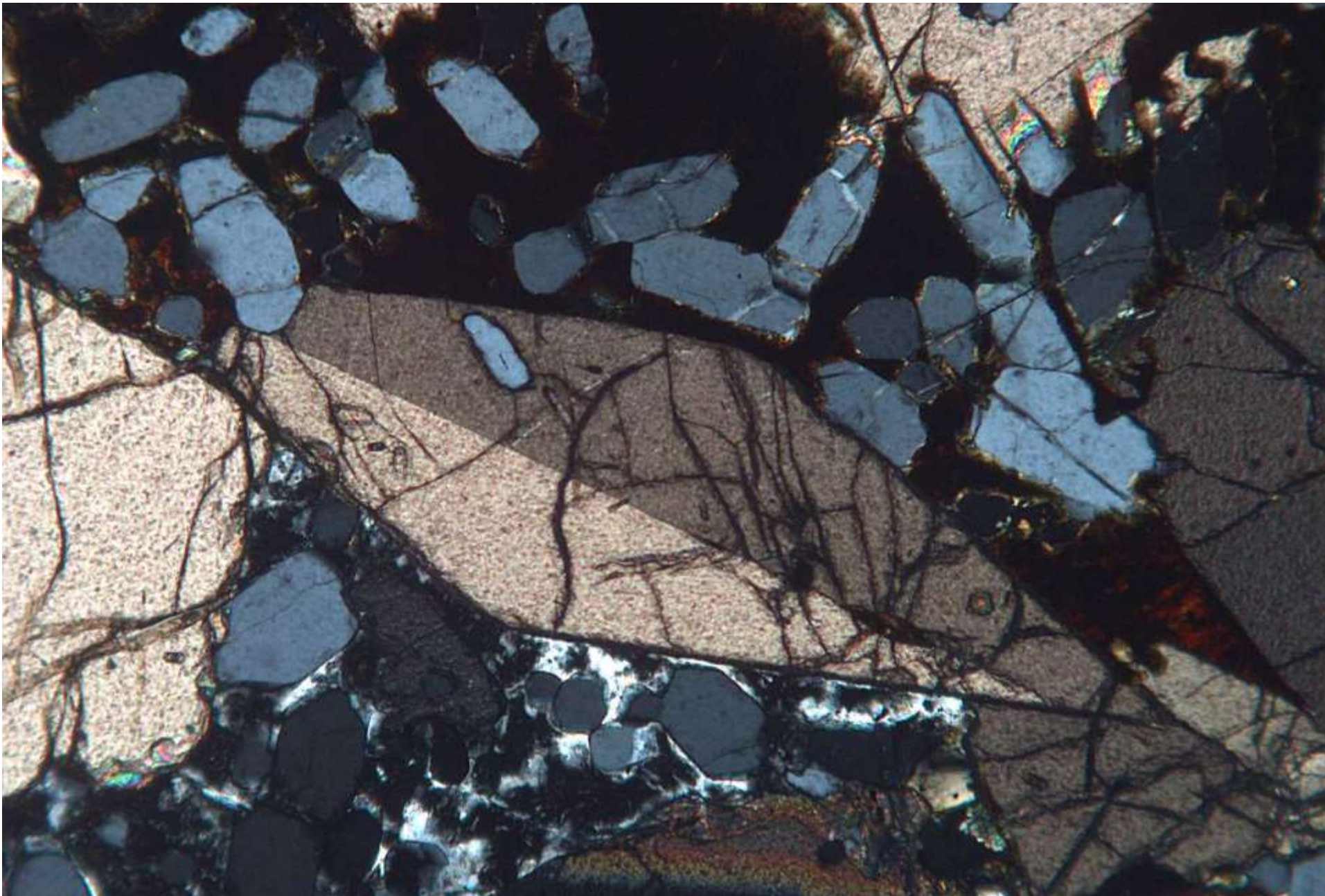
Cordierite sillimanite hornfels. Tonalini, N Italy. ppl MP

Twinned sphene with apatite (colourless), aenigmatite (dark) and nepheline (altered)



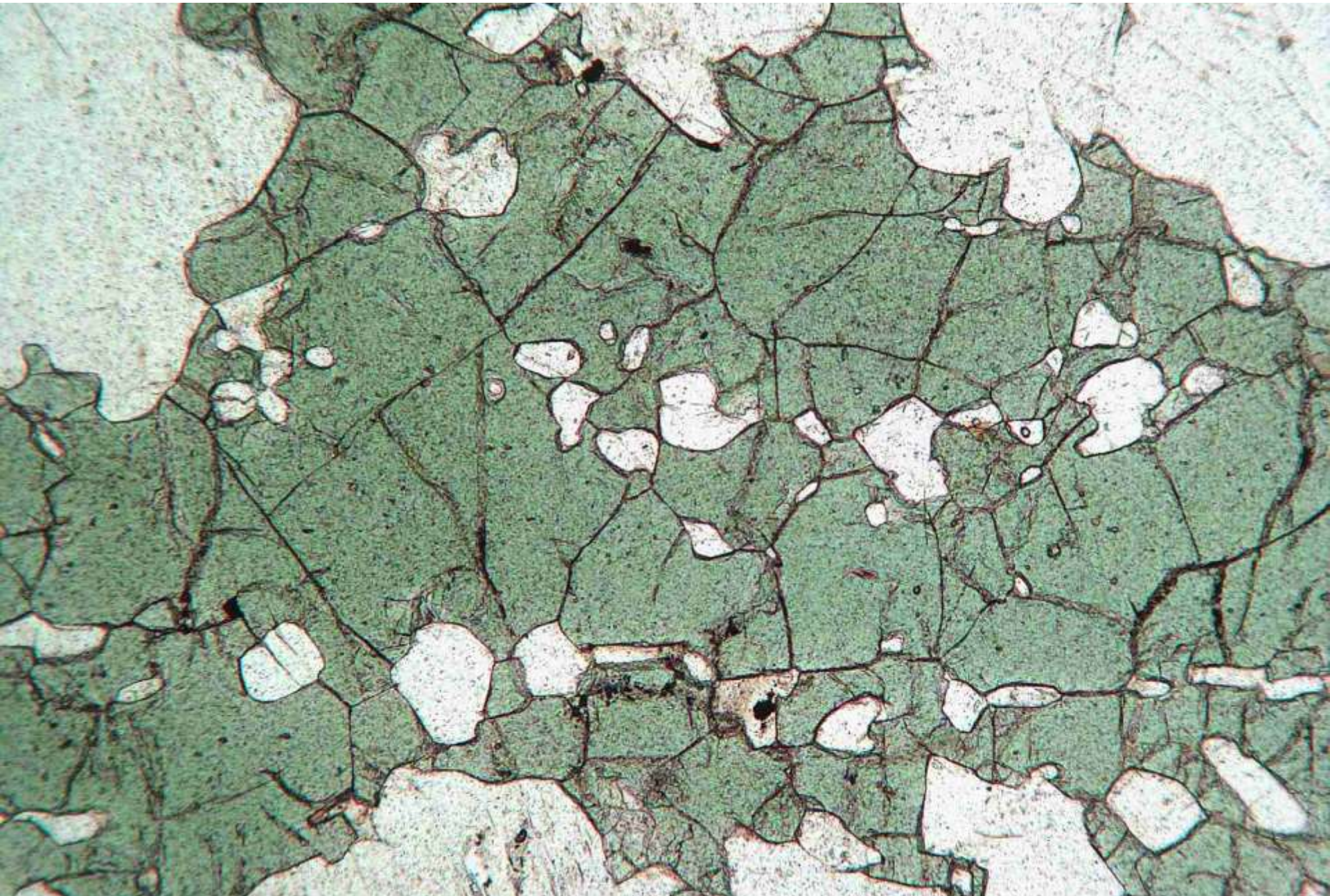
Sphene ijolite. Kirovsk, Kola Peninsula, Russia. ppl MP

Same view under crossed polars



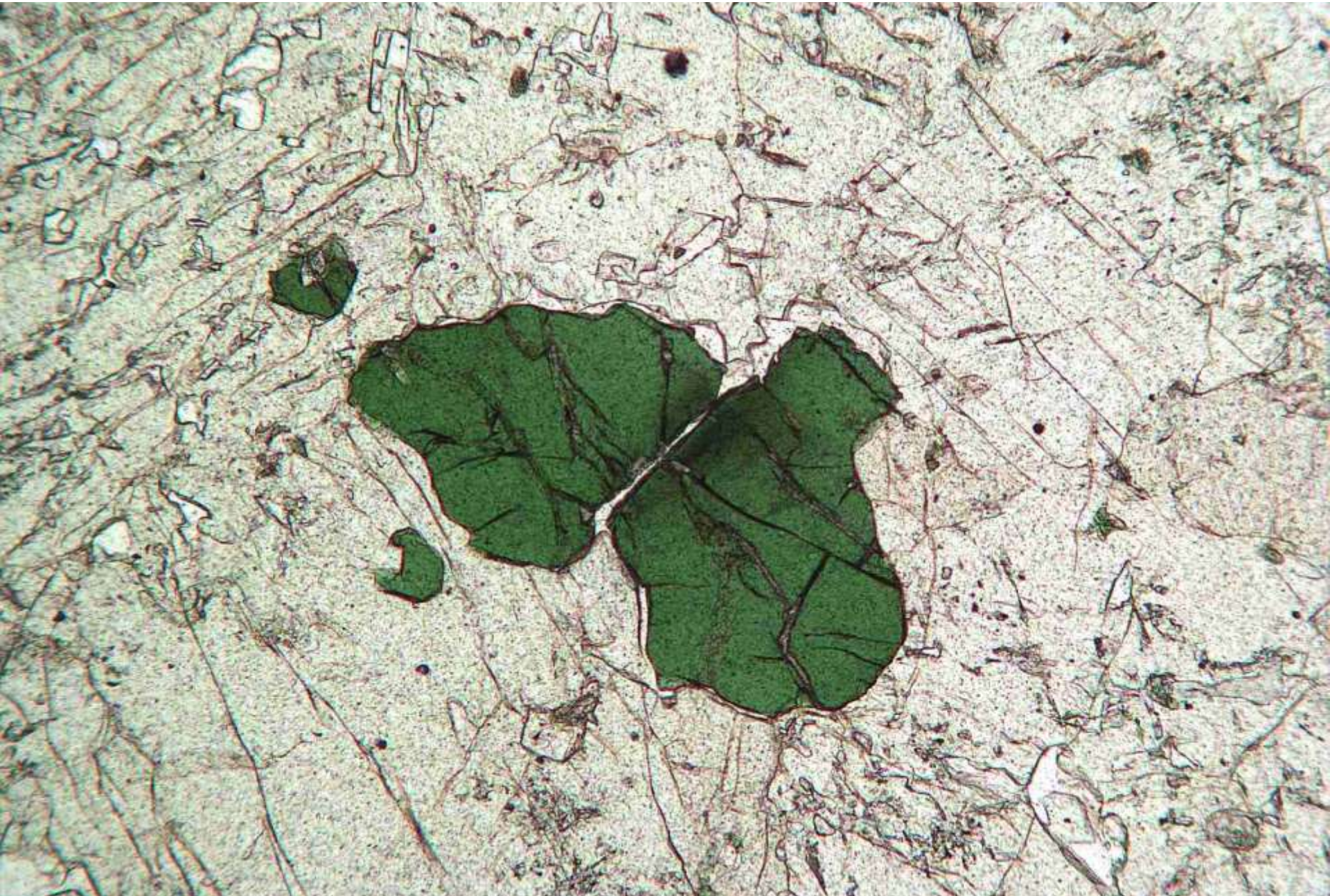
Sphene ijolite. Kirovsk, Kola Peninsula, Russia. xpol MP

Spinel (green) with plagioclase



Spinel plagioclase granofels. Diti Dip, Beitbridge, Zimbabwe. ppl MP

Spinel in diopside



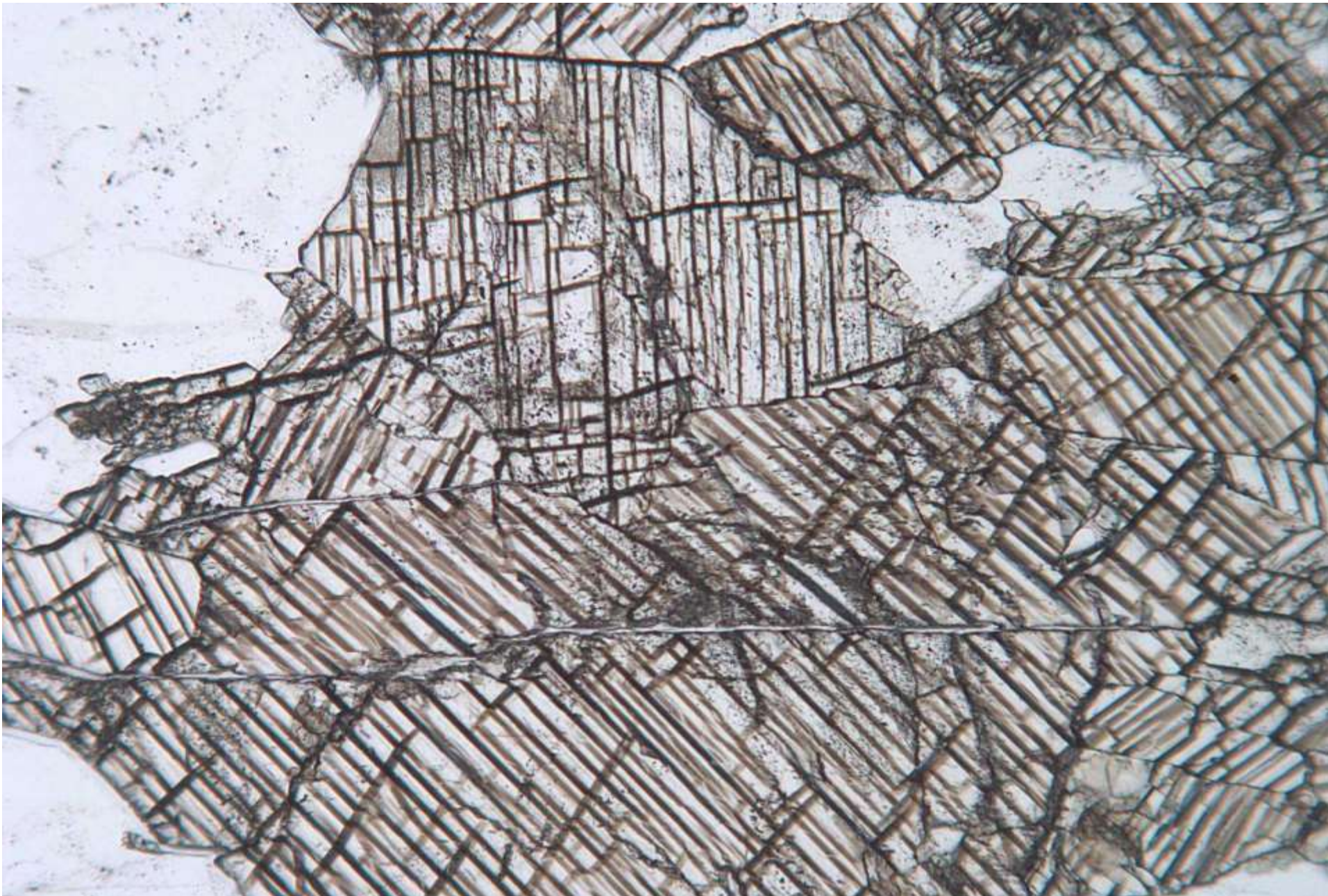
Spinel clinopyroxenite. Diti Dip, Beitbridge, Zimbabwe. ppl MP

Spinel (var. hercynite) in plagioclase



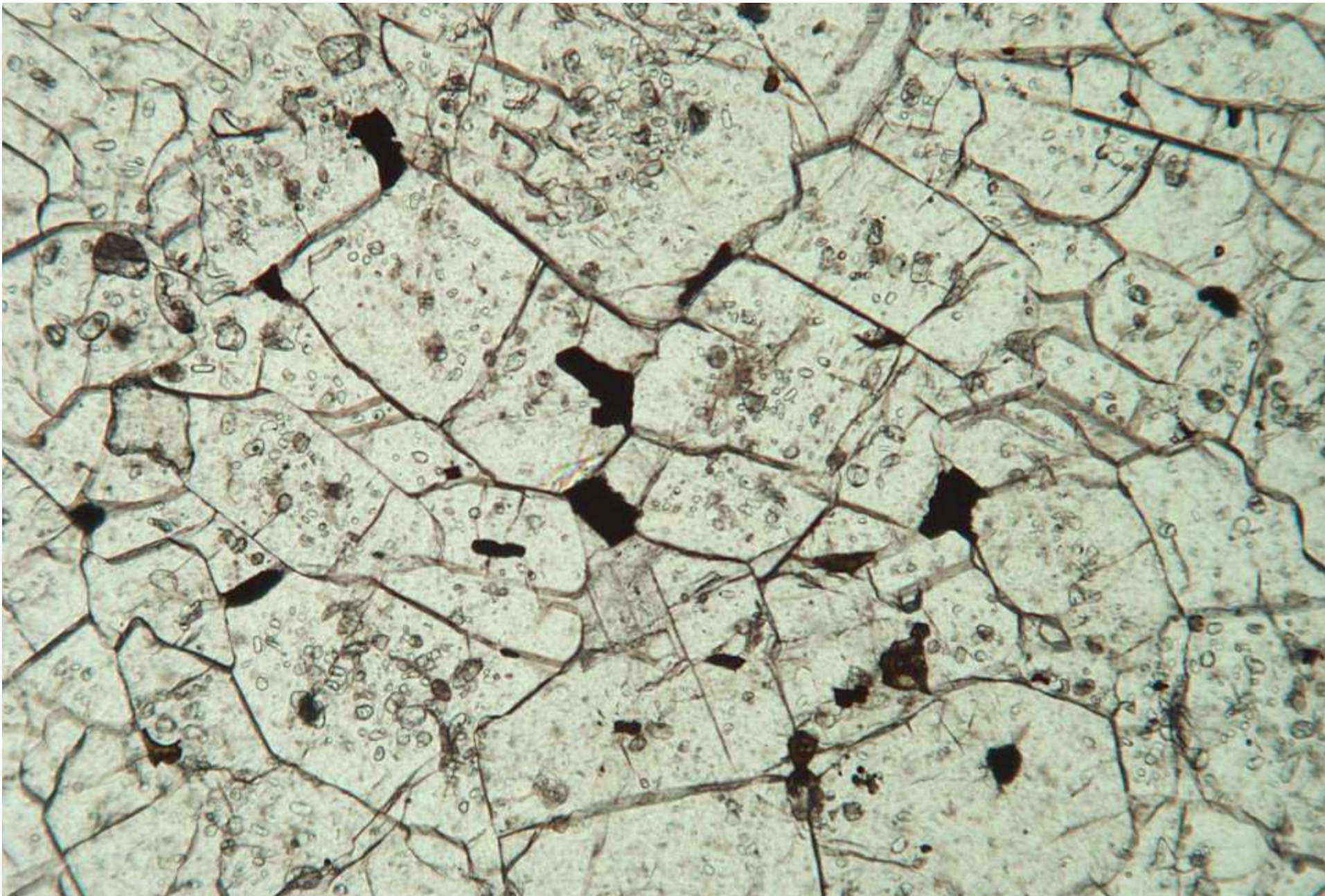
Emery. Sithean Sluain, Argyll, Scotland. ppl HP

Spodumene cross sections, showing cleavage, with quartz



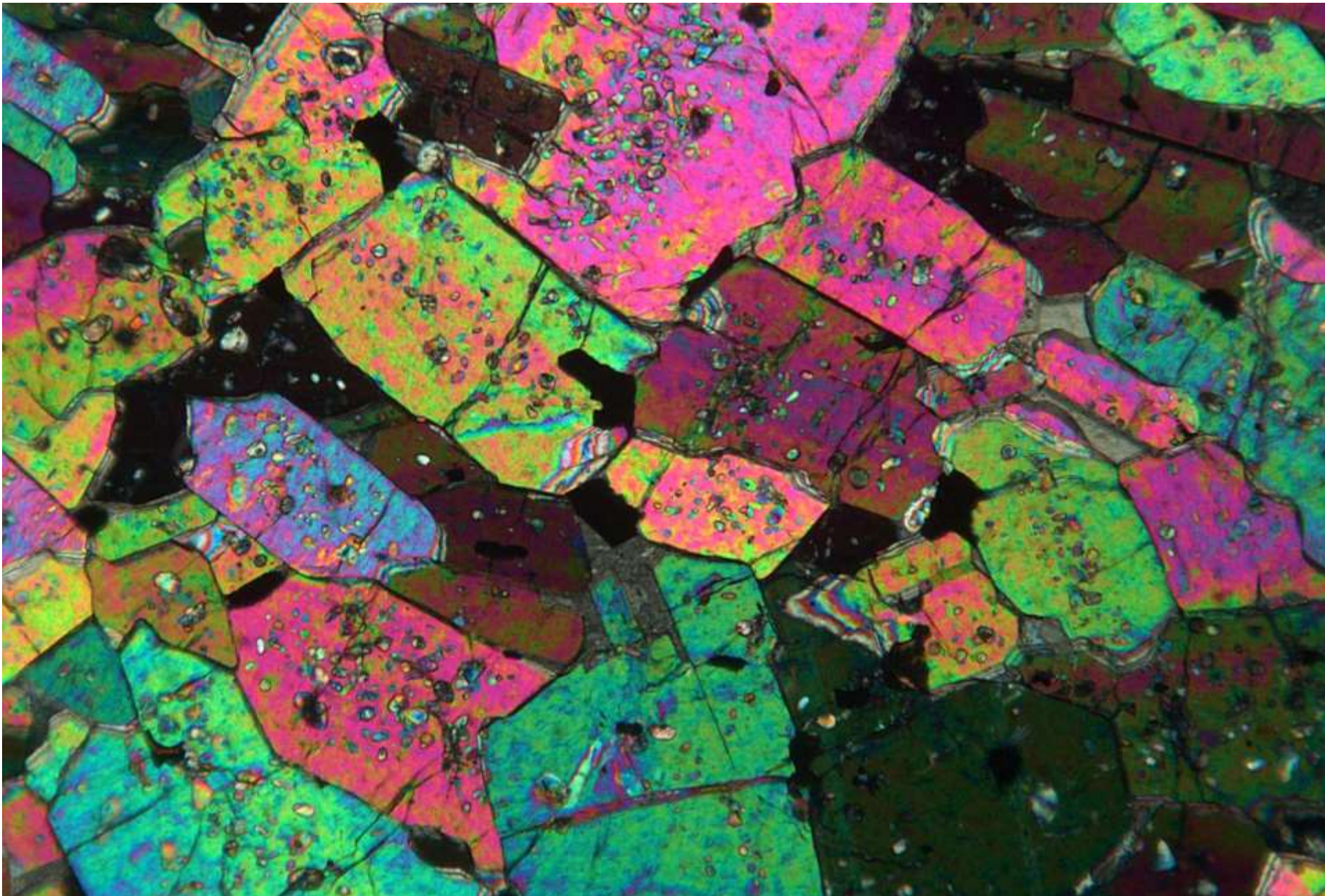
Spodumene quartz pegmatite. Varuträsk, Sweden. ppl MP

Spurrite (colourless) with spinel (dark) and interstitial calcite



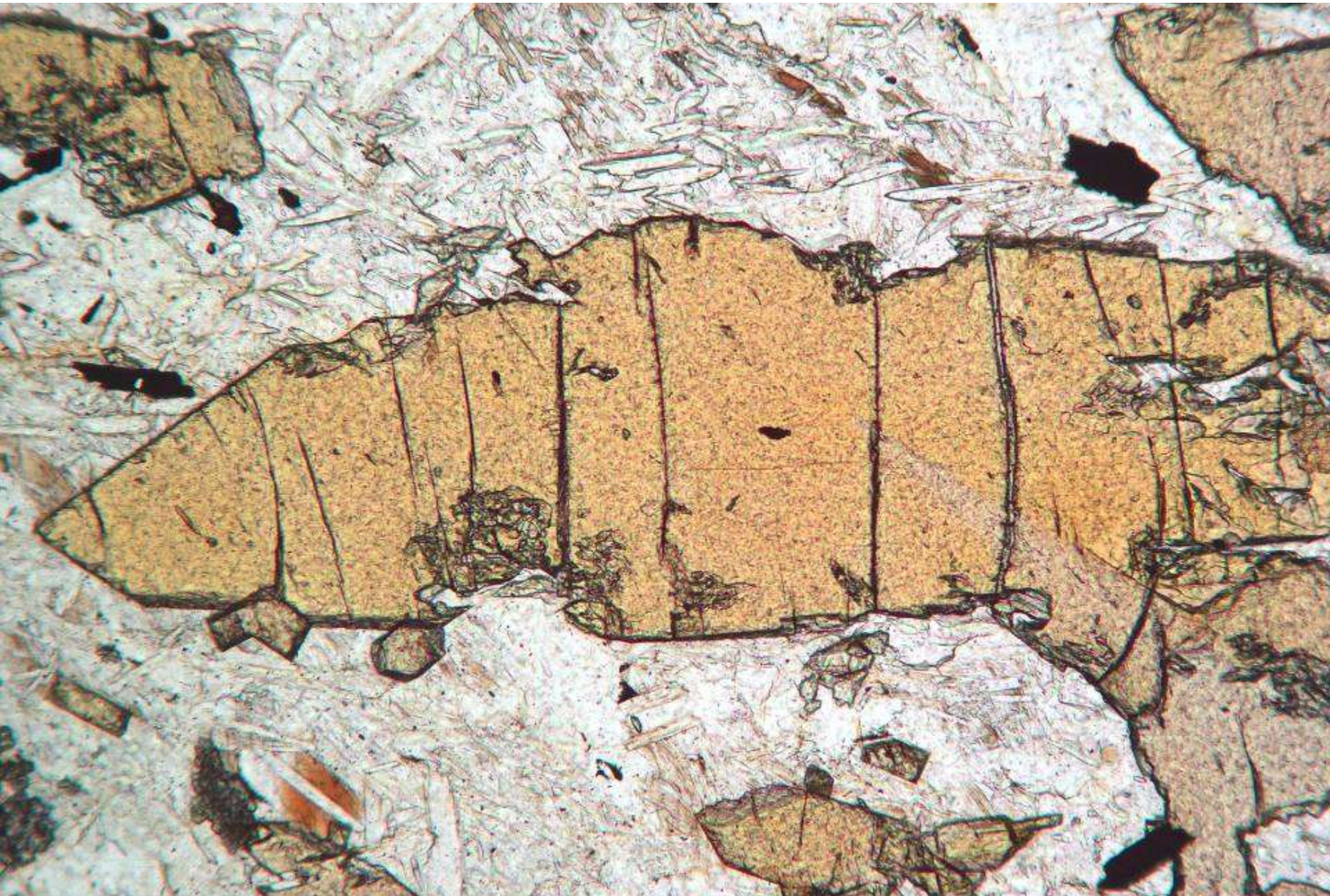
Spinel calcite spurrite rock. Scawt Hill, Larne, Northern Ireland. ppl MP

Same view under crossed polars



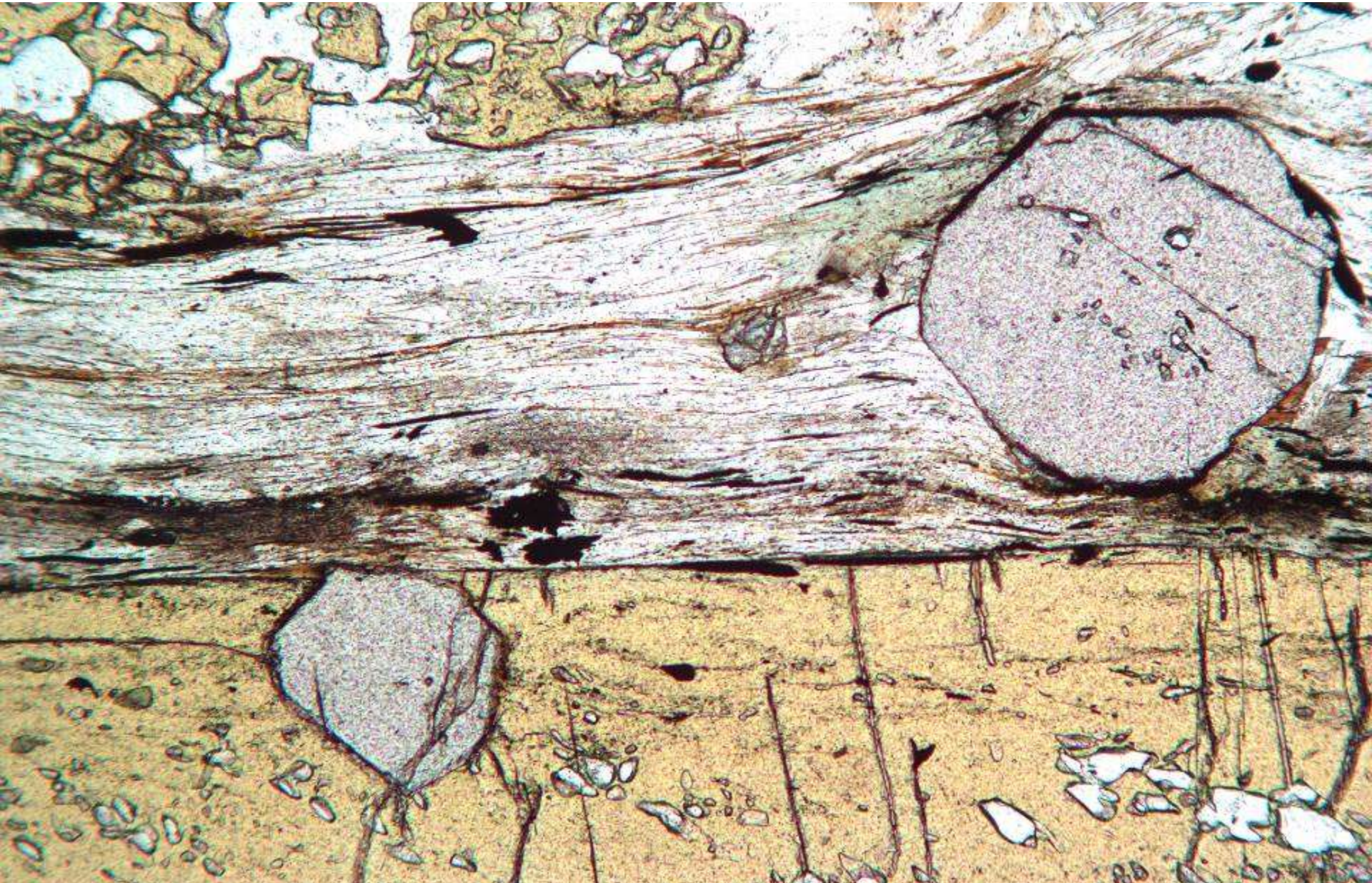
Spinel calcite spurrite rock. Scawt Hill, Larne, Northern Ireland. xpol MP

Staurolite (yellow) with muscovite, biotite and opaques



Garnet staurolite mica schist. Gössgraben, Austria. ppl MP

Staurolite (yellow) next to (and partially enclosing) garnet (pink), with muscovite, biotite, quartz, chlorite and opaques



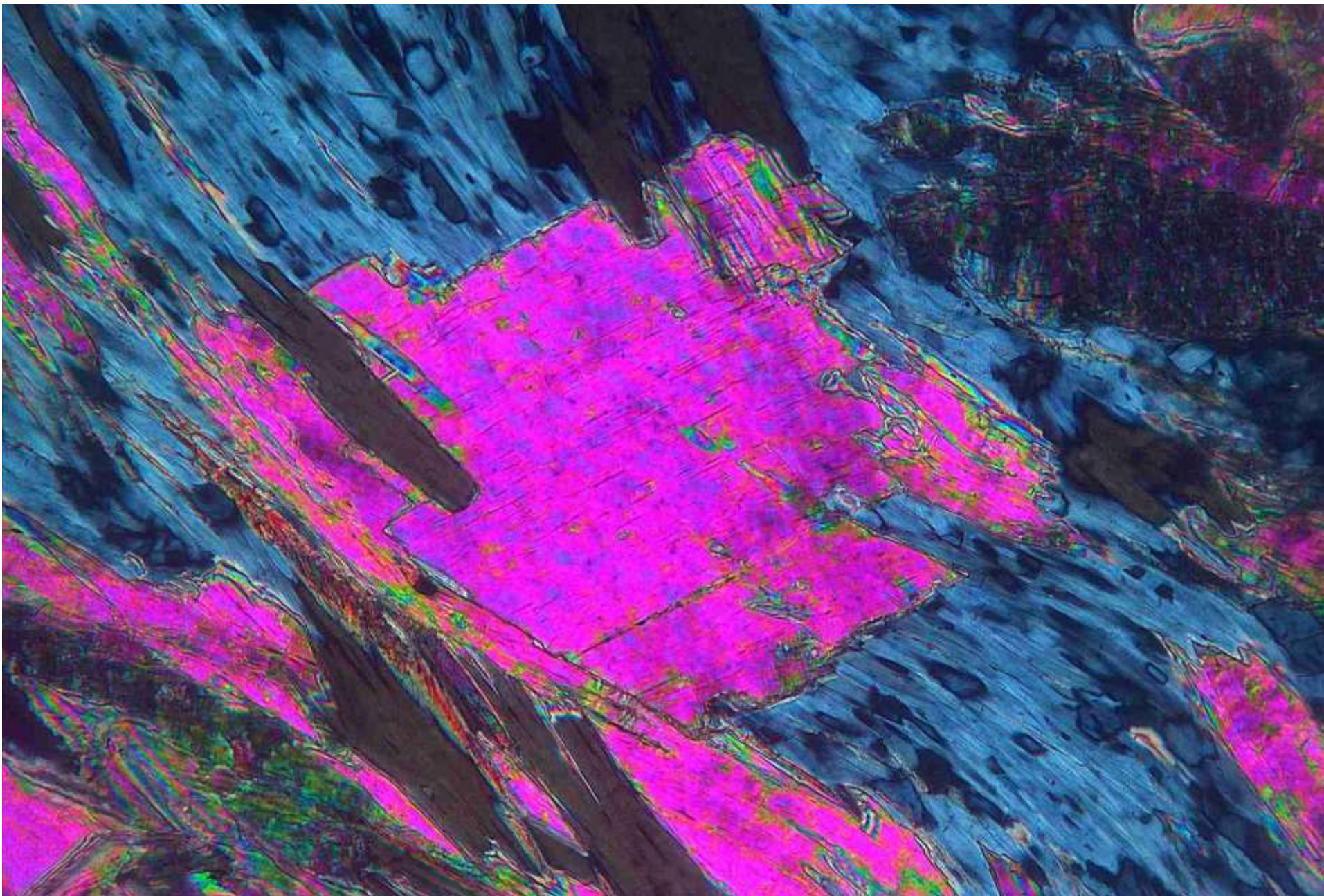
Garnet staurolite mica schist. Grange, Banffshire, Scotland. ppl MP

Stilpnomelane (brown) with tiny garnets (var. spessartine) and quartz



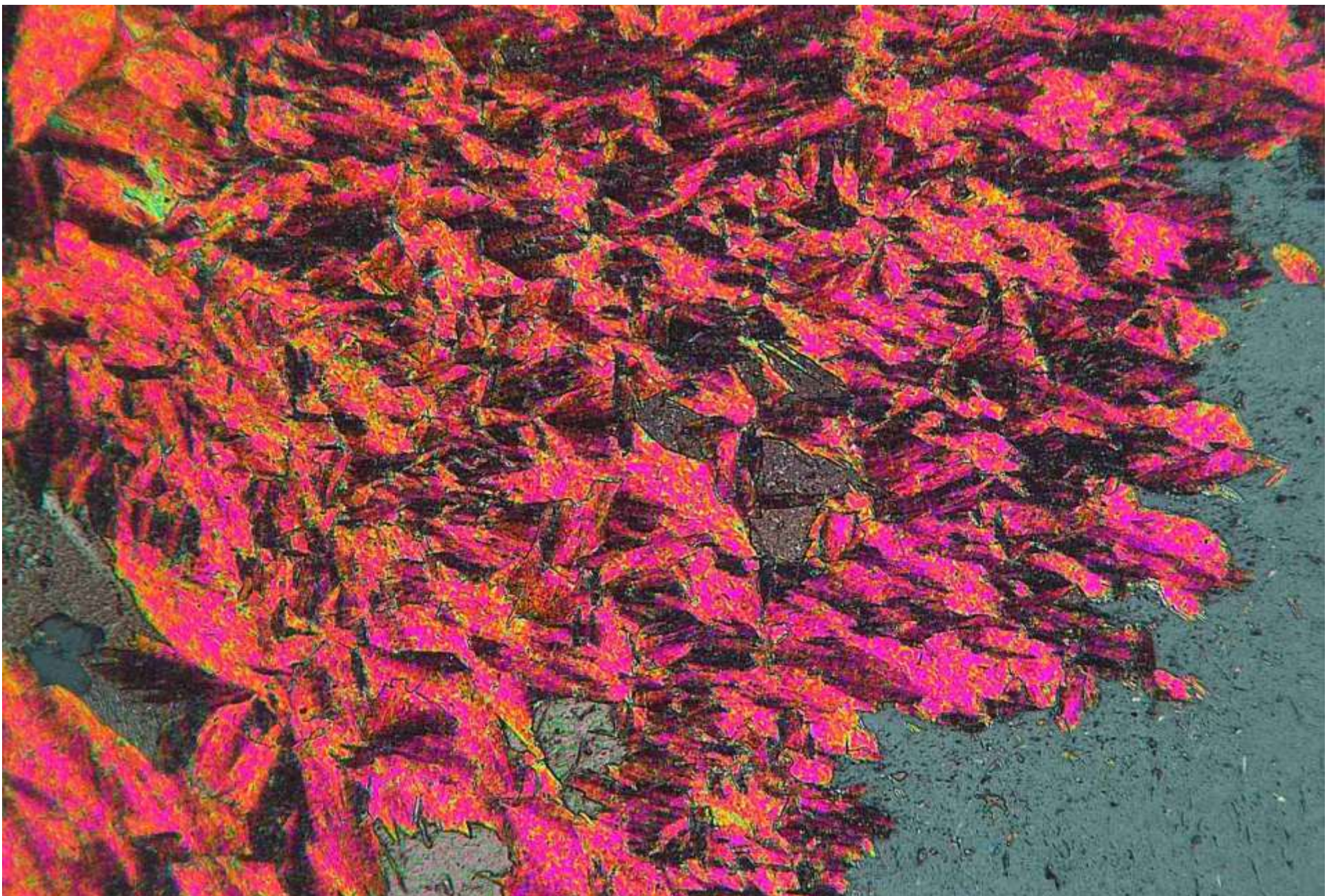
Spessartine stilpnomelane quartzite. Laytonville, California, USA. ppl MP

Talc (pink interference colours) with chlorite (brown) and antigorite serpentine (pale blue)



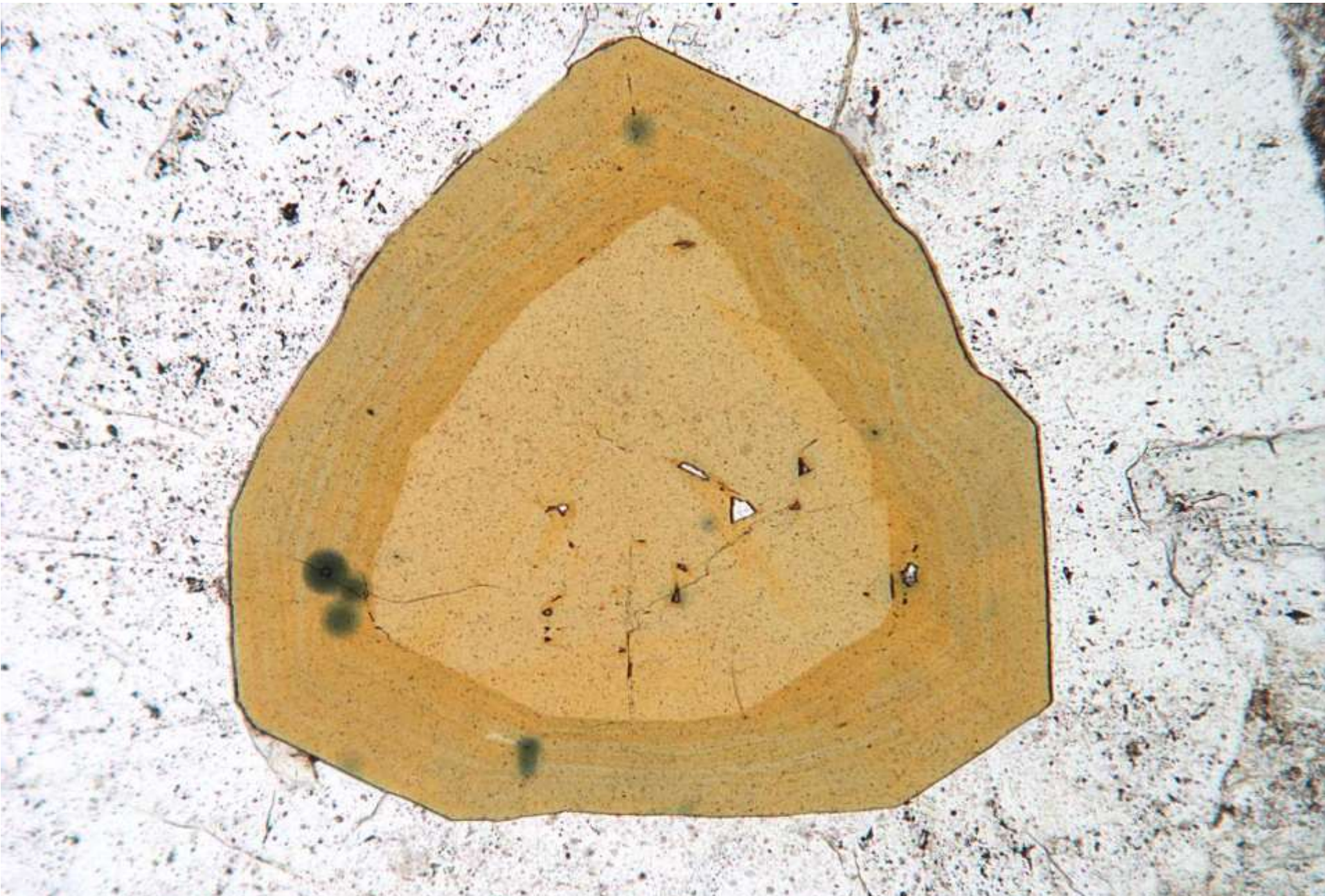
Forsterite talc antigorite schist. Ticino, Switzerland. xpol HP

Aggregate of talc crystals with quartz (at right) and calcite (buff interference colours)



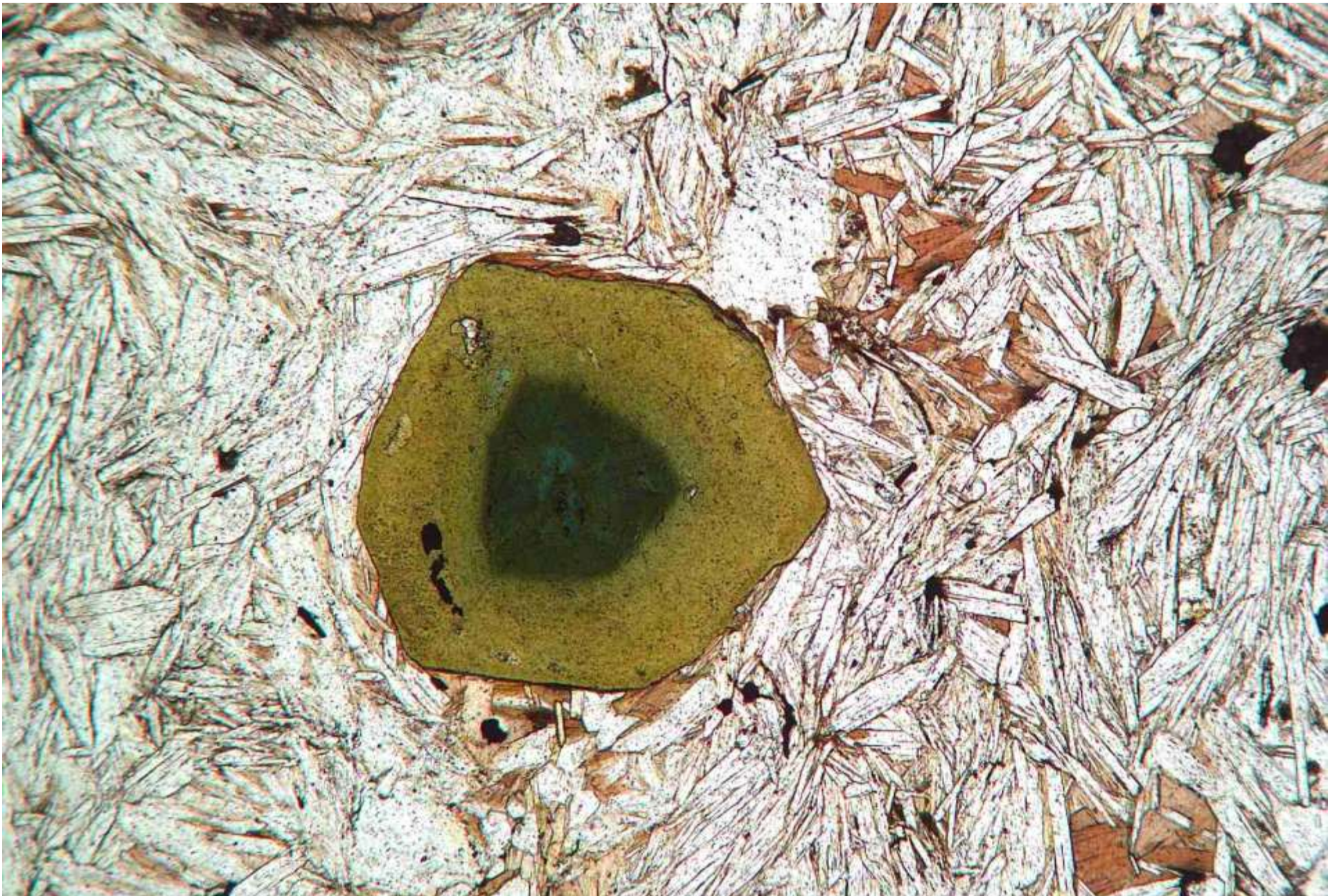
Talc tremolite marble. Campolungo, Switzerland. xpol MP

Zoned tourmaline cross section in quartz.



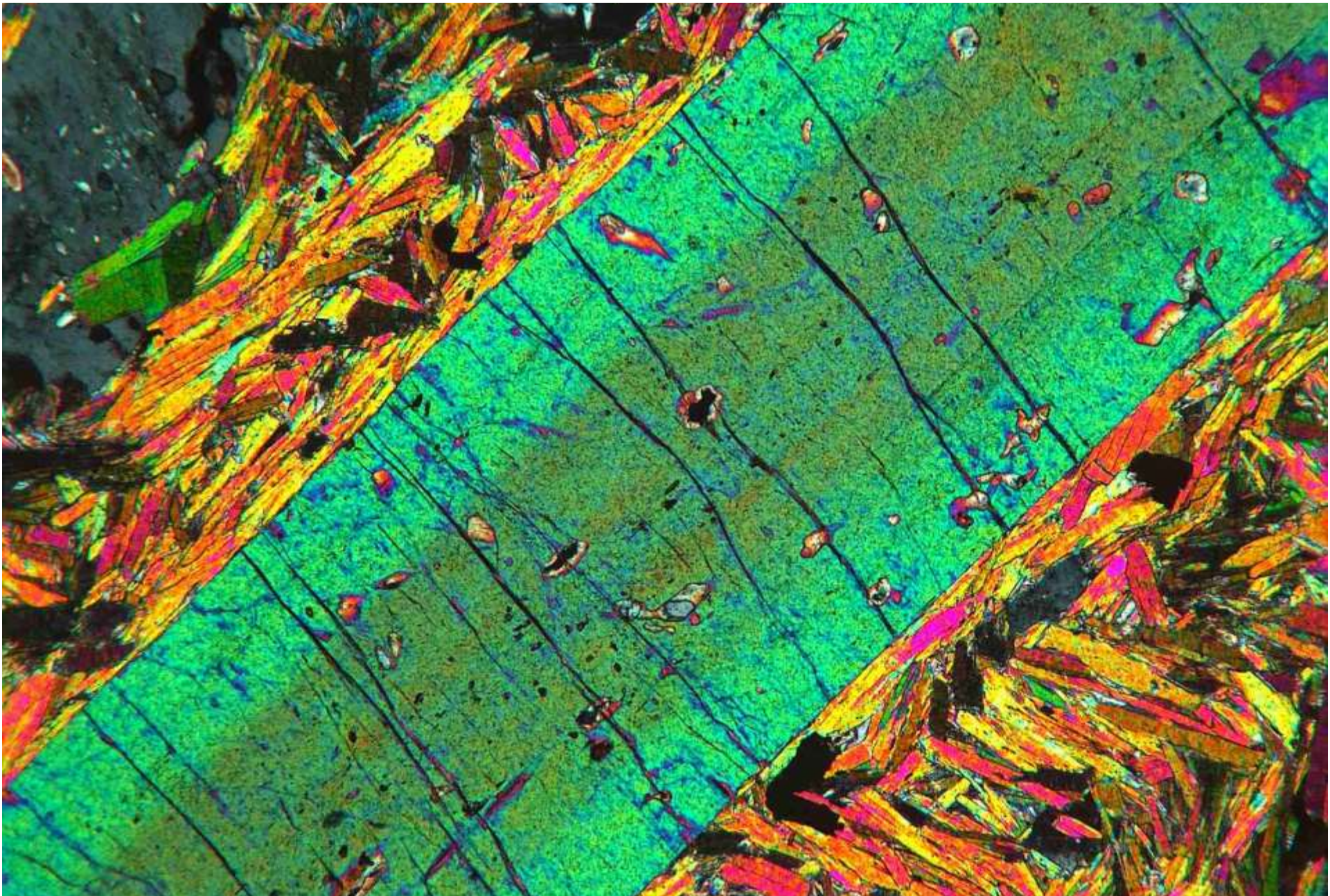
Tourmaline pegmatite. Megiligar Rocks, Cornwall, England. ppl MP

Zoned tourmaline cross section with micas and quartz and opaques



Garnet kyanite mica schist. Kirkmichael, Scotland. ppl MP

Zoned tourmaline long section in the same sample, under crossed polars



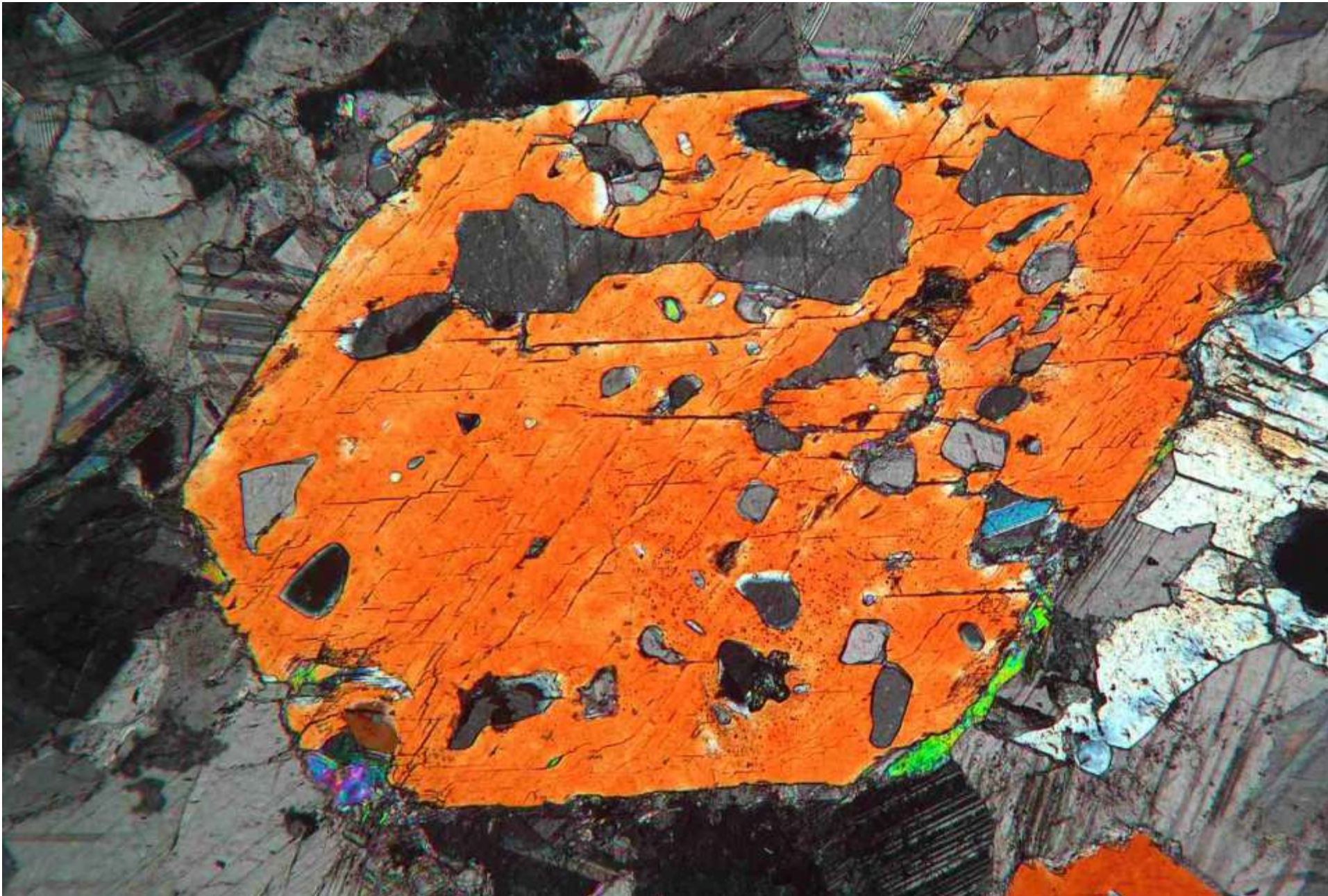
Garnet kyanite mica schist. Kirkmichael, Scotland. xpol MP

Tourmaline crystals with complex zoning. Also present: quartz (colourless)



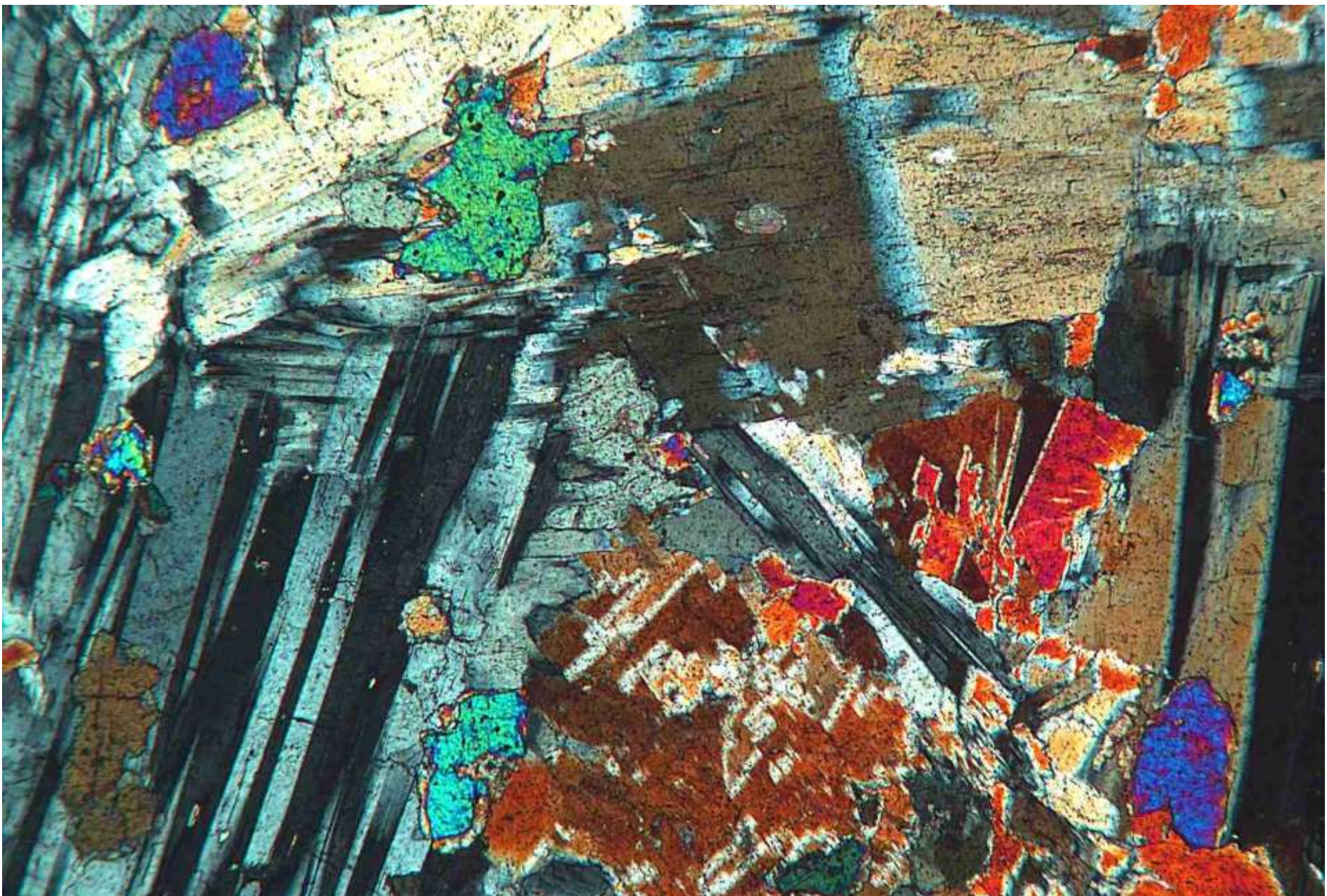
Tourmaline quartz rock, Roche, Cornwall, England. ppl MP

Tremolite cross section, showing cleavage, in calcite



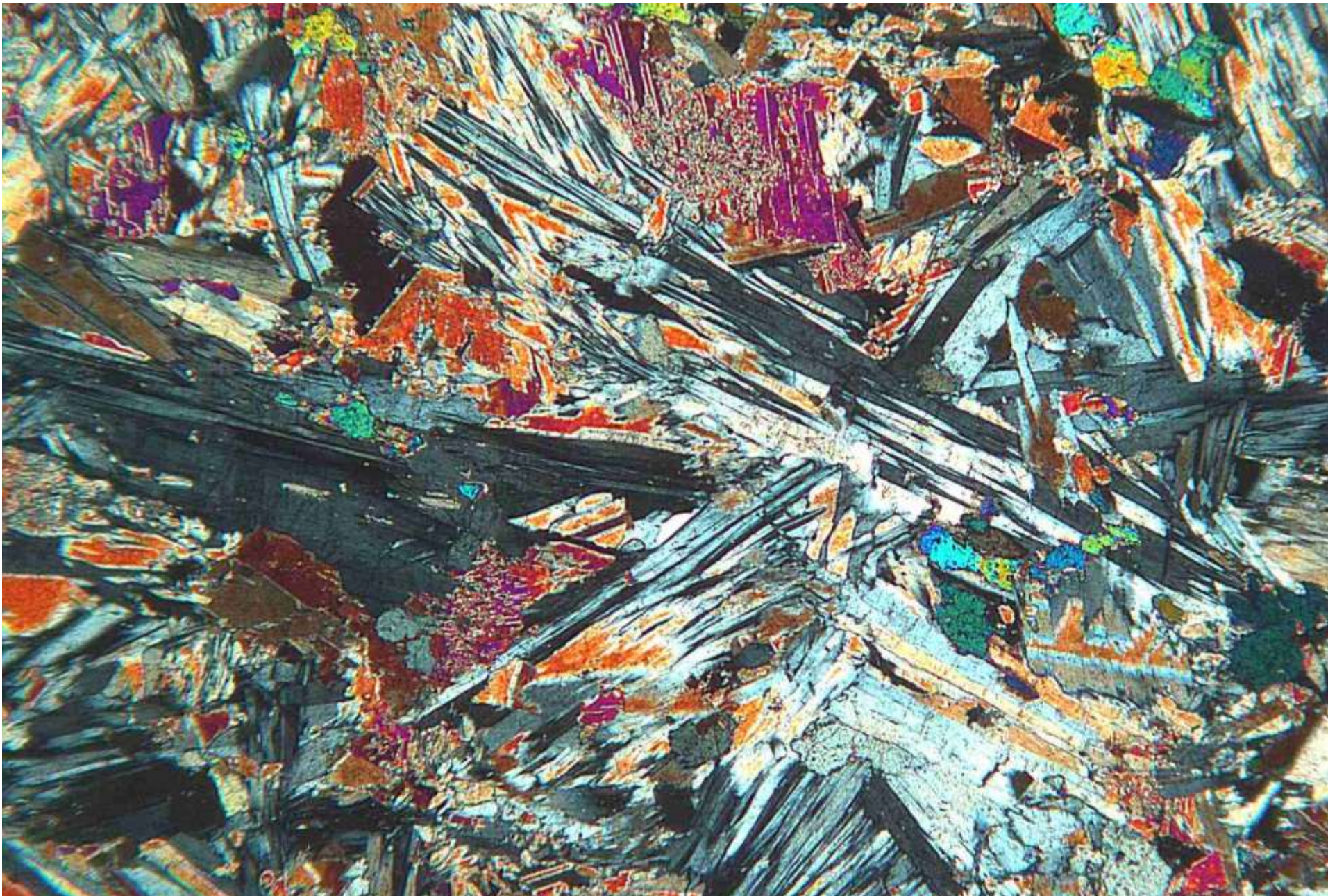
Tremolite marble. Stanziwurten Kopf, Döllach, Austria. xpol MP

Twinned wollastonite with minor diopside (green & blue interference colours)



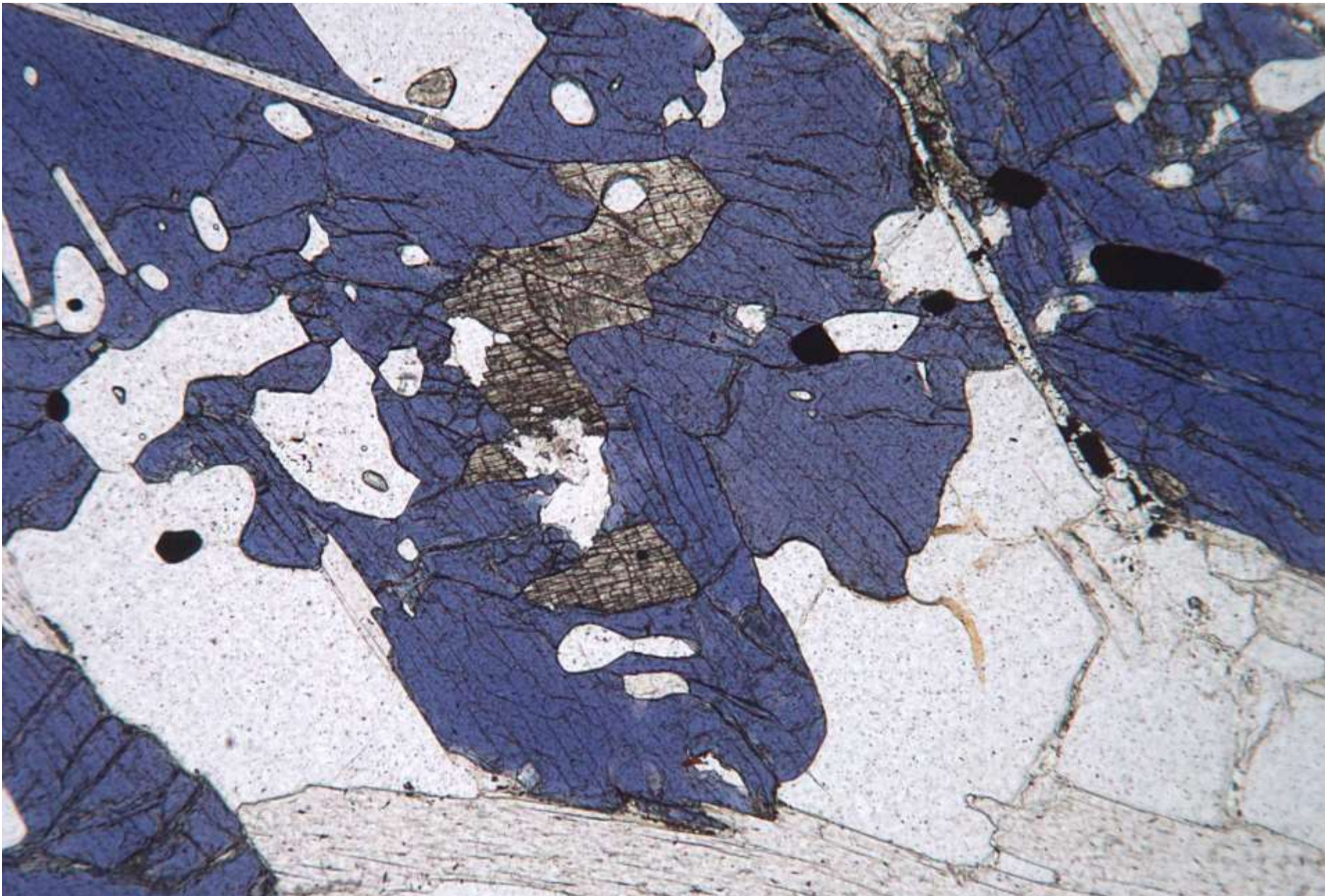
Grossular diopside wollastonite granofels. Pollagach Burn, Scotland. xpol MP

Another view from the same sample



Grossular diopside wollastonite granofels. Pollagach Burn, Scotland. xpol LP

Yoderite (blue) with inclusions of kyanite. Also present: talc, quartz and opaques



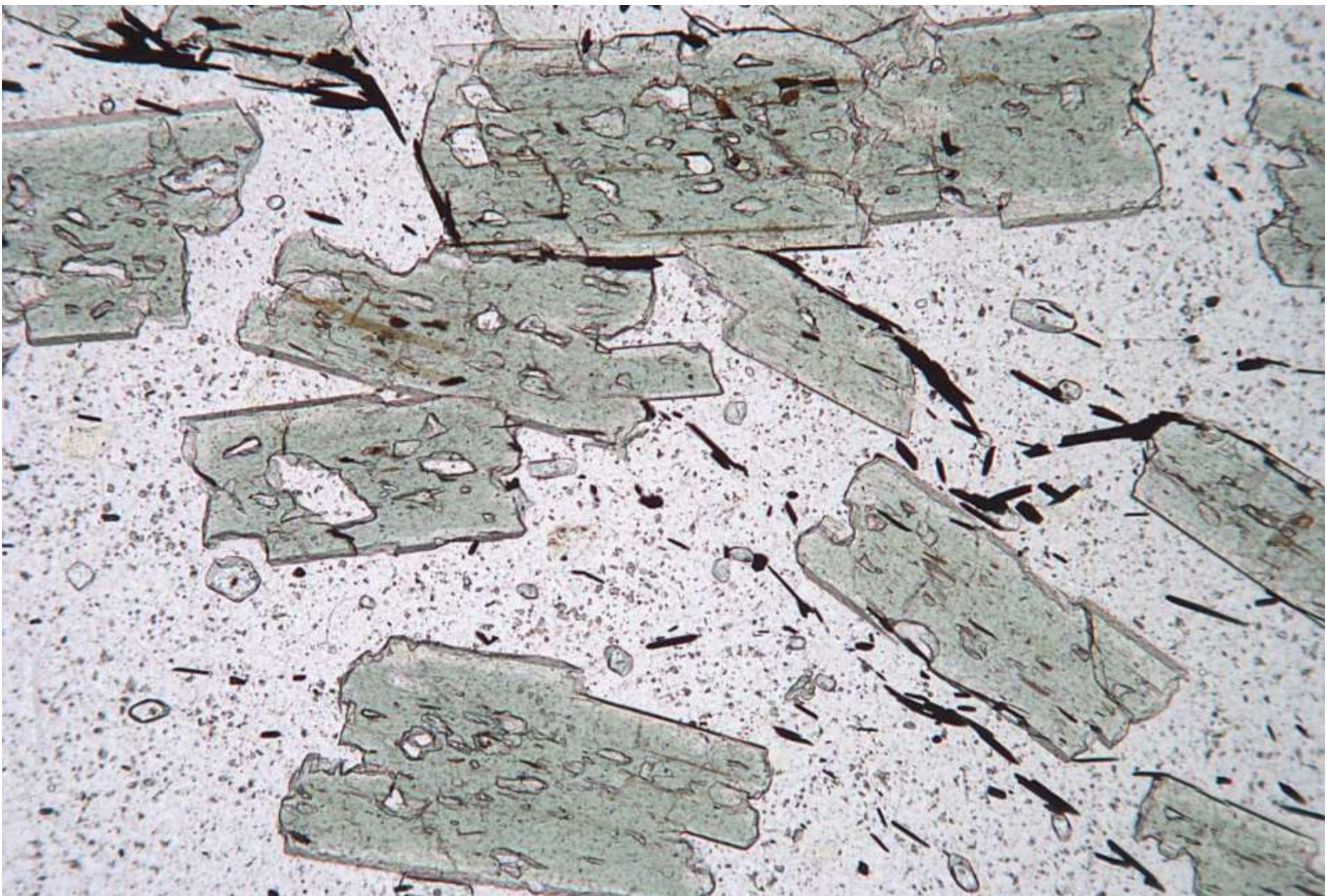
Yoderite kyanite talc schist. Mautia Hill, Dodoma, Tanzania. ppl MP

Zircon crystal (centre) with dark halo of radiation damage in surrounding biotite.
Also present: muscovite (top centre) and quartz



Kyanite gneiss. Glen Urquhart, Scotland. ppl HP

Zussmanite (green) with quartz (colourless) and deerite (opaque)



Deerite stilpnomelane zussmanite quartzite. Laytonville, USA. ppl MP