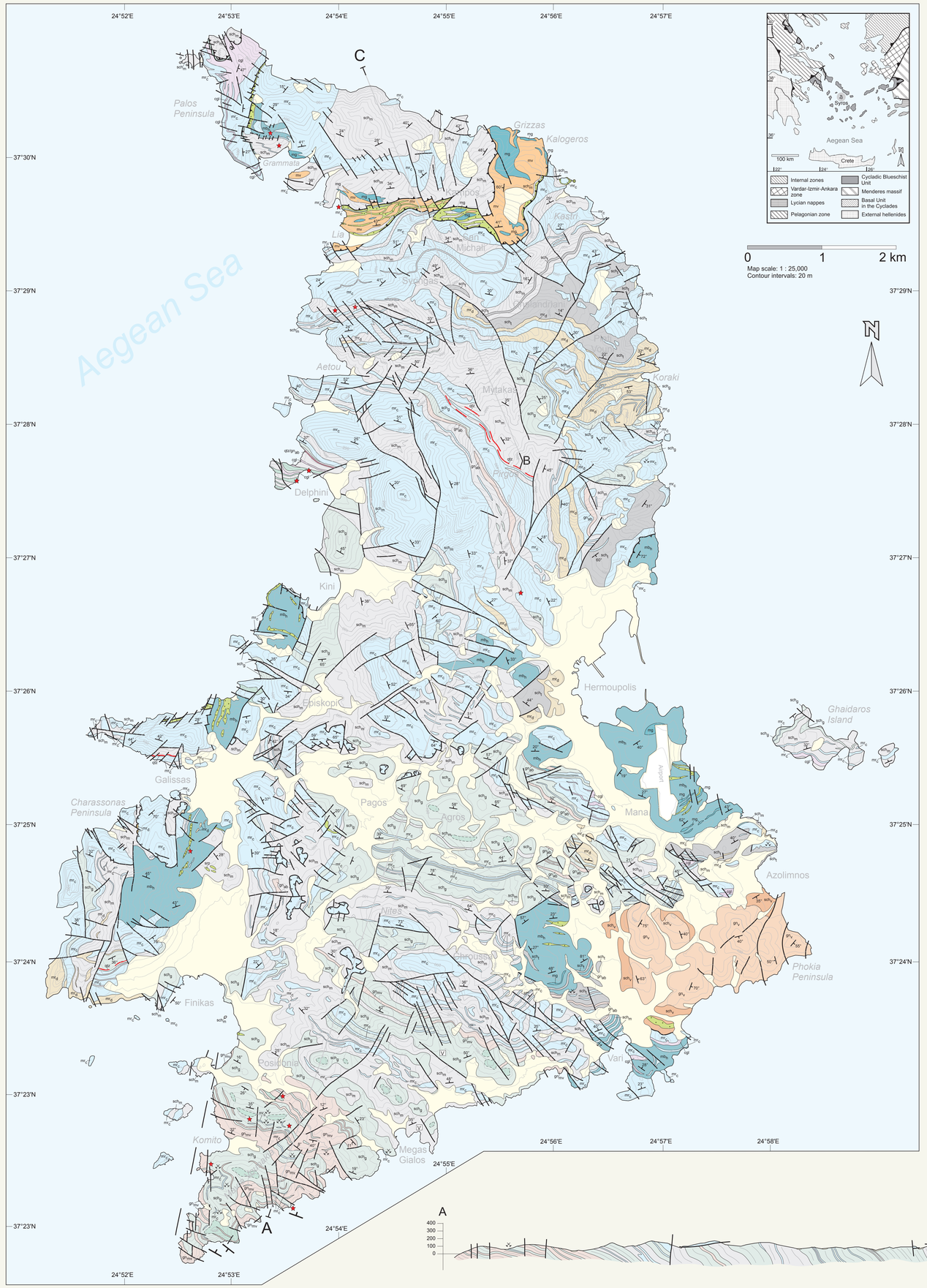
Geological map of Syros Island (Cyclades, Greece)
1:25,000



Cycladic Blueschist Unit

Calcite marble. Laminated to massive, medium- to coarse-grained light gray to blue-gray, with frequent intercalations of impure phengite-glaucophane-clinozoisite-quartz–bearing marbles, locally calcsilicates. In places matrix-supported monomict conglomerate horizons with calcite clasts in carbonate matrix, becoming frequent near contacts with schist units. Frequency and thickness of marble units decrease toward the south. Intrafolial folds on the dm- to m-scale and retrograde columnar calcite paramorphs after aragonite are in places well preserved. Surficial karst is common, sometimes so intense that interal fabrics are obscured.

Dolomitic marble. Brownish-gray to yellowish dolomite alternating with calcite marble on the cm- to dm-scale, mapped as dolomitic marble where dolomite component exceeds an estimated 20 percent. More massive dolomite units lack internal foliation and tend to form s-parallel megaboudins in ductile calcite marble up to several hundred m in length.

Metasedimentary mica schist. Foliated phengite-paragonite-quartz±glaucophane±garnet±epidote gray to bluish gray clastic metasediments, with frequent quartz segregations parallel to the s2 cleavage. Minor intercalations of mafic glaucophane-paragonites epidote±sphene±calcite blueschists, locally with static epidote-phengite-chlorite/garnet±calcite±quartz pseudomorphs after lawsonite. Toward the south, static selective to pervasive retrograde chlorite-actinolite-albite greenschist facies overprint becomes more common. Likely protoliths were graywackes and psammites with occasional mafic tuffitic intercalations. Genuine metapelite compositions appear to be rare or obscured by sodic metasomatism.

Metaconglomerate. Mostly monomict conglomeratic layers with matrix-supported calcite clasts in a foliated impure calcite to calcsilicate (calcite-phengite-quarz) matrix. Clasts range in size from mm up to several cm. Metaconglomerate units form a few m thick, laterally discontinuous layers and lenses, situated preferably at the base of marble units in contact with mica schists, indicating possible primary stratigraphic relations.
On Palos peninsula, distinctly polymict metaconglomerates several hundred m in thickness, with clasts of calcite, phengitic schist, metabasite, and occasional Mn-rich piemontite (former hydrothermal ocean-floor sediment) occur. Locally, metaconglomerates grade into massive, poorly foliated and highly resistant clast-free calcite-quartz± epidote±phengite calcsilicate felses.

Banded tuffitic schists. Mafic glaucophane-garnet-omphacite-clinozoisite±ankerite layers alternating on a cm- to dm-scale with felsic layers composed of paragonite-quartz±clinozoisite± glaucophane±garnet and albite-actinolite±hematite pseudomorphs after omphacite and jadeite. Occurrences at Azolimnos and Hermoupolis show well preserved blueschist-facies assemblages, while near Chalandriani and Galissas retrograde overprint is stronger.

Albitic garnet-bearing paragneiss. Light gray to white, coarse-grained, foliated quartz-albite-paragonite±clinozoisite lithologies with gneissic fabric, in places with cm-sized garnet porphyroblasts. Lateral and vertical gradations into quartzite. Likely protoliths are psammitic arkosic layers in graywacke units.

Quartzite. Resistant, up to several m thick albite-bearing quartzite, locally with reddish or greenish colour, cm-sized garnet porphyroblasts, and frequent, dm-sized intrafolial folds. Quartzite layers occur both inside schist and albitic gneiss units, and occasionally with metabasite. Lateral continuity typically no more than a few tens of m, in some instances (e.g., Mytakas) up to a few hundred m. Laterally grading into albitic gneiss.

Greenschists and epidote schists. Schists more strongly overprinted by greenschist-facies metamorphism show the assemblage epidote-glaucophane and/or chlorite-albite, depending on the grade of overprint. Darker green shading indicates possible metavolcanics, i.e., epidosites with pillowlike structures.

High-pressure metabasite. Tectonic mélange of blueschist-eclogite-grade fragments of a former oceanic crust, tectonically disrupted and juxtaposed during prograde deformation. Fragments include pillow-structured metabasalt, massive fine-grained and coarse-grained eclogite and omphacite pyroxenite (basaltic flows and cumulates), as well as glaucophane-clinozoisite-omphacite-paragonite±garnet blueschist (mafic tuffs and hyaloclastites), locally with static clinozoisite-phengite-chlorite-quartz pseudomorphs after lawsonite, and harzburgite serpentinite. Lithologies are too limited in extent to be discriminated on map scale. All lithologies can be associated with Mn-rich hydrothermal metasediment. In competent units and blocks in schistose matrix magmatic fabrics (pillows, cumulate textures) are well preserved.
The metabasite units are regarded as repeated tectonic slices intercalated in and structurally homogeneous with the meta-sedimentary lithostratigraphy.

Metagabbro. Competent coarse-grained metacumulate fragments in close association with metabasite units. Main assemblage is static omphacite and clinozoisite, with rare relicts of magmatic augite. Primary cumulate textures are in places well preserved, peripheries of metagabbro bodies are sheared and omphacite is replaced by glaucophane. Locally truncated by meta-plagiogranitic dykes.

Metavolcanics. Bimodal suite of mafic glaucophane-omphacite-garnet-clinozoisite and felsic jadeite-quartz±paragonite±clinozoisite metavolcanic rocks. In places (e.g., Grizzas and Kalogeros) proximal volcanic breccias with primary-magmatic depositional features are well preserved, grading laterally into a belt (north of Kampos) of highly deformed equivalents with irregularly shaped intermingled mafic and felsic bands and enclaves. These are possibly a distal and more ductile tuffitic facies of the same lithologies. Highly abundant in the Kampos area, small occurences below mappable scale occur in the metabasite units of Mana, Hermoupolis, Charassonas, and east of Chrousa.

Felsic paragneisses of Mavra Vounakia Mostly fine-grained albite-quartz–bearing paragneisses with intercalations of conglomeratic and carbonatic layers. In places, slices of kalifeldspar augengneiss are intercalated in the Mavra Vounakia succession; these orthogneisses are relicts of Variscan basement.

Serpentinite and tremolite-chlorite-talc ±actinolite schists. Tectonic block-in-matrix associations, preferably inside and at the peripheries of competent metabasite, metagabbro, and metavolcanic units. Blocks include boudins up to several tens of m in diameter of eclogite, statically recrystallized metagabbro, harzburgite-serpentinite with relict orthopyroxene, and pillowed metavolcanic units. Matrix is a pale green, sometimes vividly blue-green mylonitic antigorite-tremolite/actinolite-chlorite-talc schist locally grading into serpentinite mylonite. In places (e.g., Kampos, Vari, Finikas) massive serpentinite with no internal foliation is preserved.
Many metabasite boudins in mylonite-serpentinite schist matrix are distinctly rounded by tectonic transport, and often rimmed by highly strained monomineralic actinolite and actinolite-chlorite blackwall reaction shells, in places impregnated by static tourmaline and rutile. The serpentinite belts may mark shear zones active during prograde and retrograde deformation, likely to have accommodated significant strain during Eocene subduction.

Mn-rich metasediments. Hydrothermal Mn-rich ocean-floor deposits, in close proximity to metabasite and mafic tuffitic schist. In schist matrix occuring as bedding-parallel chert-like spessartinites (eglaucophane), as stacked layers and rootless intrafolial fold hinges; in mafic blueschist and metabasite as spessartine-glaucophane-chlorite and spessartine-omphacite layers and lenses. In calcitic marble as irregular patches of piemontite-paragonite-calcite±quartz with Mn-oxides, at Palos also as clasts in carbonatic conglomerate. Lateral continuity is limited to a few tens of m.

Vari Unit

Gneisses of Vari. Predominantly albite+phengite+epidote+quartz (magnetite-ilmenite-titanite-potassic feldspar) trondhjemitic orthogneisses, locally with apitic veins. A granodioritic variety, e.g., on Phokia Peninsula, shows the assemblage hornblende (pargasite tschermakite)+albite+epidote+phengite+quartz (titanite-ilmenite). A closely spaced foliation is commonly overprinted by a widely spaced, steep cleavage, superimposing on the gneiss an L-tectonite fabric. Peripheral parts of the gneiss are in places intercalated with slices of mica schist, amphibolite, and carbonate up to a few m in length (possible relicts of original country rocks). Possible intrusive contacts, i.e., apilitic veins interfolded with amphibolite, are preserved south of Azolimnos. Along fractures, faults, and toward its margins, the gneiss may be retrogressed to greenish chlorite-epidote-actinolite–bearing varieties.

Mylonitic chlorite schists of the Vari Unit. Mafic mylonitic schists and phyllites. Main assemblage is chlorite, actinolite, albite, clinozoisite and white mica. In places, with intercalations of massive or crenulated serpentinite.

The Vari unit, i.e., gneiss proper and its mylonitic margin, is likely to form part of the Cycladic Upper Unit. Amphibole chemistry suggests epidote-amphibolite facies metamorphism, with the paragenesis hornblende+albite±epidote±garnet in mafic lithologies within the gneiss.
Evidence that the gneiss was affected by the Eocene high-pressure metamorphism, i.e., jadeite relicts or albite pseudomorphs after jadeite-quartz (common in felsic lithologies of the high-pressure units), is lacking. Contacts with high-pressure units are covered by alluvium or controlled by steep, late-stage brittle faults.

Unmetamorphosed rocks

Andesitic intrusives. Unmetamorphosed, fine-grained andesitic or latitic dikes.

Alluvial cover. Undifferentiated; coastal deposits, sands, gravel, caliche and debris.

Geological boundary

Strike and dip of foliation

Late-stage brittle fault

Prograde, foliation-parallel thrust fault, in places showing brittle overprint

Late-stage brittle thrust fault

Abandoned ore pit

Petrological history of the Cycladic Blueschist Unit:

Protolith age of oceanic fragments: ~ 80 Ma.

Age of blueschist- to eclogite facies metamorphism (M1): ~ 52 Ma.

Age of greenschist overprint (M2): 25-18 Ma.

Petrological history of the Vari Unit

Protolith age of orthogneisses: 244-240 Ma.

Age of epidote-amphibolite facies metamorphism: 100-95 Ma.

Peripherical schists of the Vari Unit probably represent a Miocene shear zone.