

GEOLOGICAL MAP OF THE VILLALVERNIA - VARZI LINE between Scrivia and Curone valleys (NW Italy)

QUATERNARY DEPOSITS

Cairo Montenotte Synthem

Rocchetta Cairo Subsynthem (CMT₃). Clast-supported gravelly and gravelly-sandy fluvial deposits, fresh or slightly weathered (2.5Y), covered by a decimeter to meter thick overbank deposits made up of sands with planar to wavy lamination or massive silts and silty sands (*Holocene - Present*)

Dego Subsynthem (CMT₂). Fluvial deposits made up of clast-supported sandy gravels, slightly weathered (2.5Y), covered by a decimeter to meter thick overbank deposits, made up of silty sands with planar lamination or massive. Deposits form broad terraces perched 2-4 m above the streambed of the Scrivia River (*uppermost part of late Pleistocene - Holocene*)

Saliceto Subsynthem (CMT₁). Fluvial deposits made up of clast-supported sandy gravels, crudely bedded and slightly weathered (10YR), covered by a decimeter thick overbank sandy silty deposits. Deposits form narrow terraces perched 4-6 m above the streambed of the Scrivia River (*uppermost part of late Pleistocene*)

Merana Synthem

Badia Vecchia Subsynthem (MEA₄). Fluvial deposits made up of clast-supported sandy gravels, moderately weathered (10-7.5YR), covered by a metre thick overbank sandy silty massive deposits. Deposits form broad terraces perched 5-16 m above the streambed of the Scrivia River (*late Pleistocene*)

Pian del Gatto Subsynthem (MEA₃). Fluvial deposits made up of clast-supported sandy gravels, moderately weathered (10-7.5YR), locally covered by a metre thick (3-4 m) overbank sandy silty sediments with planar lamination. Deposits form terraces perched 10-20 m above the streambed of the Scrivia and Curone rivers (*late Pleistocene*)

Madonna della Neve Subsynthem (MEA₂). Fluvial deposits made up of clast-supported sandy gravels, moderately weathered (10-7.5YR). Deposits form terraces perched about 25 m above the streambed of the Scrivia River. (*late Pleistocene*)

Piandendice Synthem (PND)

Fluvial deposits made up of clast-supported sandy gravels, highly weathered (5-2.5YR), permeated by veinlets of iron-manganese oxides. Deposits form terraces perched 35-75 m above the streambed of the Scrivia River (*upper part of early Pleistocene - middle Pleistocene?*)

Unconformity

PRE-QUATERNARY SUCCESSION

Argille Azzurre (FAA). Brownish-to greyish fine-grained sand, locally with planar parallel bedding, interbedded by decimeters thick levels of yellow medium-to coarse grained sandstone. Fossil remains consist of gastropods, bivalves, brachiopods, echinoids, and plant fragments. Thickness: >200 m (*early Pliocene*)

Unconformity

Gessoso - Solifera Group

Cassano Spinola conglomerates (CCS). Grayish to brownish pelite and siltstone, in millimeters to centimeters thick beds, interbedded by tabular to lenticular matrix-supported conglomerate and sandstone horizons (CCS₁), tens of meters thick. Fossil remains consist of ostracods and brackish waters mollusks (*Congerina sp.*) and plant fragments. Thickness: >500 m (*late Messinian*)

Unconformity

Valle Versa Chaotic Complex (CTV). Chaotic complex with block-in-matrix fabric, consisting of polymictic blocks, decimeters to some meters in size, randomly distributed within clayey marl with brecciated texture. Blocks are composed of: selenitic gypsum (CTV₁), dolostone and vuggy dolomitic limestone ("evaporitic carbonates", CTV₂), micritic limestone with remains of *Lucina sp.* and polygenetic carbonate breccia (CTV₃), and fossiliferous micritic limestone (CTV₄). Thickness: <100 m (*late Messinian*)

Unconformity

Sant'Agata Fossilil marls (SAF).
Upper pelitic member (SAF₁). Grayish clay and marl rich in planktonic foraminifera (*Globigerinoides obliquus*, *Orbulina sp.*, *Globigerina multiloba*). Methane-derived carbonate-rich blocks (*) occur in the upper part of the unit (Ripa dello Zolfo). Thickness: 10-150 m (*Tortonian - early Messinian*). In the upper part of the unit a channelized body (Sant'Alasio conglomerate, SAF₂), consisting of silty-sand interbedded by three lenticular horizons of conglomerate (SAF_{2a}), tens of meters thick, with clasts of micritic limestone and quartzite from millimeters to decimeters in size. Thickness: 100 m (*early Messinian*)

Lower silty-sandy member (SAF₁). Brownish-to yellowish sandstone alternating with gray siltstone, passing upward to medium-to thick beds of sandstone. Fossil remains consist of gastropods, bivalves, echinoids, corals and plant fragments. The upper part of the unit is characterized by slump scars, slumping and debris flows deposits (North of Sant'Andrea) up to tens of meters thick. In the lower part of the unit (Vargo, SE of Cornigliano), a lenticular body of alternating sand and conglomerate, tens of meters thick, occurs (SAF₁). Thickness: 200-250 m (*Tortonian*)

Unconformity

TERTIARY PIEDMONT BASIN (Borbera Grue succession)

Serravalle Formation (SEV). Yellowish sandstone in medium-to thick beds, alternating with grayish cemented sandstone in decimeters thick beds, with large-scale cross-bedding. Silty-pelite beds, up to decimeters thick, are interbedded in the lower part of the unit. Thickness: 200-300 m (*Serravallian*)

Cessole Formation (CES). Siltstone alternating with whitish-to light gray burrowed sandstone, yellowish fine-grained sandstone, and whitish marl, in decimeters thick beds. The base of the unit is outlined by an horizon, up to some meters thick, of sandstone and crystalline-derived conglomerates, representing a lag deposit (Famero superiore, San Vito, M. Ronzone). Thickness: 0-250 m (*Langhian*)

Unconformity

Rigorso Formation (RIG). Grayish marl and silty marl with intercalations of graded yellowish sandstone, decimeters thick (RIG₁). Brownish volcanoclastic deposits occur with two horizons, up to decimeters thick, in the upper part of the succession (Famero inferiore). Thickness: 100-300 m (*Rupelian - Aquitanian*). The upper part of the unit is characterized by brown-to yellow massive sandstone (RIG₂), with medium-to thick beds, alternating with whitish siltstone. Thickness: 0-150 m

Monastero Formation (MST). Marly clay and silty marl in decimeters beds with intercalations of fine-to medium grained turbiditic sandstone and siltstone, in centimeters to decimeters thick levels, and medium-to coarse grained turbiditic lithoarenite, in decimeters to meters thick beds. Lenticular bodies of arenite ("arenitic lithofacies", MST₁), up to hundreds of meters thick and pinching-out toward north, are interbedded within the Formation (SE of Baiarda, SSE of Garbagna). Thickness: >600 m (*Rupelian*)

Fault contact

EPILIGURIAN UNITS

Bismantova Group

Monte Vallassa sandstones (AMV). Yellowish sand and fossiliferous sandstone, in decimeters thick beds, locally with cross-bedding, passing to microconglomerates and bioclasts. Fossil content consists of rodolites of red algae, bryozoan, corals, echinoids, lamellibranchies (*Pectinidae sp.*), brachiopods (*Terebratula sp.*), and gastropods. The basal part of the succession is characterized by a discontinuous horizon of conglomerate with lithodome holes, representing a trasgressive lag deposits. Thickness: >150 m (*Langhian? - Serravallian - Tortonian?*)

Unconformity

Monte Lisone Chaotic Complex (CML). Chaotic complex with block-in-matrix fabric, consisting of tabular to irregular shaped blocks, decimeters in size, randomly distributed within a clayey marl matrix. Blocks are mainly composed of marly-limestone and calcarenite sourced from Helminthoides Flysch. Thickness: 10-30 m (*late Burdigalian - Langhian?*)

Unconformity

Contignaco Formation (CTG). Whitish calcareous marl and silty marl, interbedded by siltified marl with brownish-orange weathered surfaces and containing sponge spicula, radiolarians, rare planktonic foraminifers and pteropods. Thickness: 0-150 m (*Burdigalian*)

Antognola Formation (ANT). Grayish-to brownish silty marl intercalated with decimeters thick graded and laminated sandstone. Planktonic foraminifera assemblage characterized by *Catapsydrax dissimilis*, *Paragloborotalia opima opima*, *Globigerinoides primordius*. Thickness: >300 m (*Rupelian - early Aquitanian*). Lenticular chaotic-rock bodies or olistostromes ("Polygenetic argillaceous breccias", ANT₁), up to 50-60 meters thick, are interbedded within the unit. They consist of highly disrupted polymictic assemblage of blocks sourced from "the basal complex" of Ligurian Units (Argille varicolori, Scabiazza sandstones, Palombini shales), External Ligurian Units (Monte Cassio Flysch), and Epiligurian Units (Ranzano Formation).

Ranzano Formation (RAN)

Varano de' Melegari Member (RAN₁). Alternating dark gray pelite and light gray arenite (a/p<1) with tabular beds intercalated by pelitic-arenite intervals (a/p>1) with thick lenticular beds (RAN₁). Lithic component of pelite sourced from Helminthoides Flysch of External Ligurian Units. The base of the Member is locally characterized by a lenticular body of conglomerate (Piaggio and Montaggio; RAN₂), tens of meters thick, with clasts sourced from sedimentary successions of External Ligurian Units. Thickness: 150-300 m (*Rupelian*)

Val Pessola Member (RAN₂). Tabular beds, decimeters thick, of grayish-to green pelite alternating with greenish arenite (a/p<1) and intercalated by coarse-grained arenite and microconglomerate intervals with thick lenticular beds. Lithic composition of arenite sourced from denudation of ophiolitic Ligurian Units and related sedimentary covers. Thickness: 0-500 m (*late Priabonian - early Rupelian*)

Unconformity

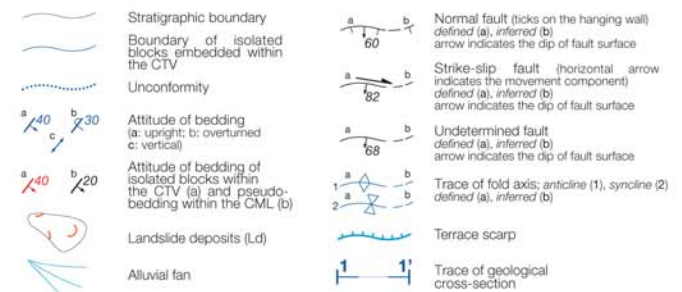
Monte Piano marls (MMP). Pinkish-to reddish marl (MMP₁), passing upward to gray-to greenish calcareous marl and badly stratified marl (MMP₂) with abundant planktonic foraminifera (*Acirina brooki*, *Globigerinatheka mexicana*, *Turborotalia cerroazulensis*). Thickness: 50-100 m (*middle - late Eocene*).

Unconformity

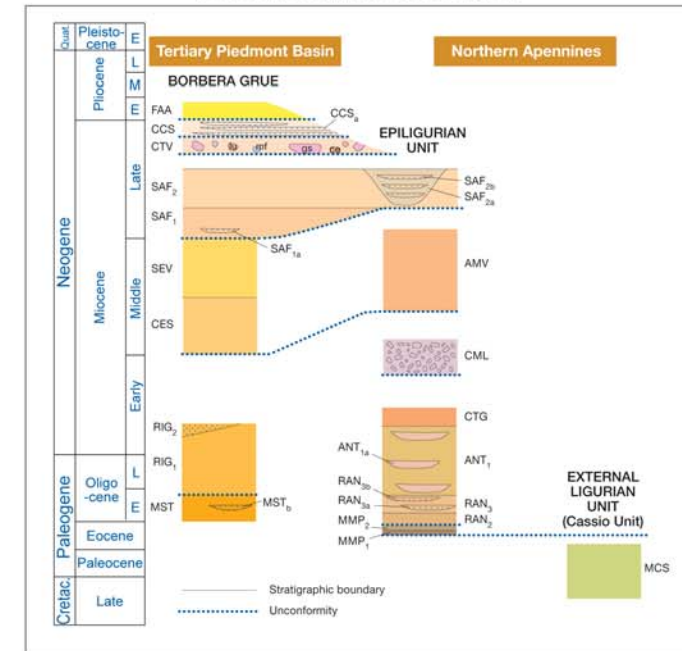
EXTERNAL LIGURIAN UNITS (Cassio Unit)

Monte Cassio Flysch (MCS). Clayey-marly alternating with grayish calcareous turbidites alternating with grayish to light brown fine-grained calcarenite, in decimeters to one meter thick beds. Thickness: >400 m (*late Campanian? - early Eocene?/?*).

SYMBOLS



STRATIGRAPHIC COLUMNS



Scale 1:20,000

m 250 0 500 1,000 1,500 2,000 2,500

