Volcanological map of Somma-Vesuvius (Italy)

SCALE 1:20,000

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QUATERNARY DEPOSITS

Alluvial, eluvial and colluvial deposits: *Gravelly to sandy-gravelly epiclastic alluvial deposits filling the bottom of the main valleys of Vesuvius and Regi Lagni channels (and related settling pools). Gravels, sands and silty-sands due to the superficial reworking of the pyroclastic deposits on the slope of Somma-Vesuvius.* ***Age:*** *Late Holocene-Present.*

Slope and fan deposits: *Slope debris of the Somma caldera and crater of Vesuvius, consisting of lava pebbles and boulders mixed with gravelly scoriaceous and pumiceous material. Debris fan formed by coarse lava gravels sometimes originated by landslides.* ***Age:*** *Late Holocene-Present.*

Lahars: *Matrix supported gravelly and sandy-gravelly deposits, from coarsely stratified to massive. They are composed of volcaniclastic materials in which pumice, scoria or lava fragments may prevail. In areas outside the volcanic edifice, these deposits comprise also variable amounts of carbonate clasts.* ***Age:*** *Late Holocene-Present.*

Littoral deposits: *Well-sorted coarse and medium-sized sands intercalated to gravel beds, mainly black in color. These deposits are composed of prevalent lava fragments and subordinated pyroclastic (pumice and scoria), rounded clasts both in the coarse and fine fraction. Loose, mainly weathered ferric crystals are abundant.* ***Age:*** *Late Holocene-Present.*

APRON SOMMA-VESUVIUS

ASV *- Apron Somma-Vesuvius, irregular alternation of primary, pyroclastic deposits and epiclastic deposits (e.g. debris flows) deriving from the dismantling of pyroclastic products present on the slopes of the volcano, particularly following the most recent Pompei, Pollena, and AD 1631 eruptions. In general, the apron is developed above the lava flow deposits constituting the Monte Somma edifice. In some sectors of the volcano, the apron is prevalently composed of pyroclastic deposits related to specific eruptions (e.g., the Avellino pyroclastics and the following Interplinian AP deposits preceding the Pompei pyroclastics in the E sector). In the eastern sector of the volcano, the 1906 and 1944 fall deposits are outcropping at the top of the apron.* ***Age:*** *Late Holocene-Present*

PHASE 4

Activity of Vesuvius cone (AD 1631 - AD 1944): Lava and pyroclastic deposits which have built the Vesuvius cone after the AD 1631 eruption.
The deposits of 16 of 18 eruptive cycles of Vesuvius activity have been reported. The only products not properly recognized or mapped in the field are related to the 1st and 4th cycle (1638-1682 and 1700-1707). Lavas have both pahoehoe and aa morphology; most of them are porphyritic (leucite and pyroxene) and with highly-phonolitic composition. The 1822, 1872, 1906 and 1944 violent strombolian eruptions represent the most intense explosive events, producing widely dispersed and maggable tephra deposits over and away from the volcanic slopes between NE and SE sectors. Juvenile products have distinctive mineral parageneis. (e.g. biotite and pyroxene in 1822 and 1906 deposits, pyroxene and leucite in 1944 deposits).

1944 Hot avalanches (va) *- Avalanche deposits due to the sliding of hot spatter layers (proximal deposits of the 1944 eruption lava fountains) induced by intense seismic tremors.*

lv20 *- Lavas (a) of 1944 eruption.*
1944 Fallout deposits (b) *- Different types of deposits ranging from welded scoria deposits (**sw**, related to proximal deposits from lava fountaining activity), to yellowish and lithified ash deposits (**pl**, related to phreatomagmatic activity) to grey tiny ash with intercalated broccias (**pc**, related to both vulcanian and phreatomagmatic activity). They are mapped above or very close to the 1944 cone. Metric-to decimetric-thick, dark scoriaceous lapilli beds from proximal slopes up to >10 km from the vent related to lava fountains and dispersed to the SE. Juvenile clasts contain abundant crystals of pyroxene, and their composition changes from foiditic-tephritic to tephritic from bottom to top deposits. Fragments of cumulates and skarns are common on the topmost.*

lv19 *- Lavas of 1913-30 eruptive activity.*

lv18 *- Lavas (a) of 1906 eruption.*
1906 fallout deposits (b) *- Grey greenish to black scoriaceous lapilli beds related to lava fountain activity. Lapilli with porphyritic texture (pyroxene, biotite e subordinately leucite), highly vesicular at the base and reddish beds and moderately vesicular at top, where trase crystals of olivine and pyroxene occur. Upper fallout beds composed of moderately to poorly scoriaceous lapilli from a sustained plume, with phenocrysts of pyroxene, and abundant lava lithics; they are typically coated by a brownish patina and range from tephrite to foiditic-tephrite in composition.*

lv17 *- Lavas of 1875-1903 eruptive activity.*

lv16 *- Lavas (a) of 1875-72 eruptive activity.*
1872 fallout deposits (b) *- Black scoriaceous lapilli beds related to lava fountain activity.*

lv15 *- Lavas of 1864-68 eruptive activity.*

lv14 *- Lavas (a) and scorias (b) of 1854-61 eruptive activity.*

lv12 *- Lavas of 1841-50 eruptive activity.*

lv12 *- Lavas of 1835-39 eruptive activity.*

lv11 *- Lavas of 1825-34 eruptive activity.*

lv10 *- Lavas (a) of 1822 eruption.*
1822 fallout deposits (b) *- Decimetric-thick, black scoriaceous lapilli beds related to lava fountain activity covering coeval and previous lava deposits. Lapilli are coated by a reddish patina.*

lv9 *- Lavas of 1794-1820 eruptive activity.*

lv8 *- Lavas (a) and scorias (b) of 1783-94 eruptive activity.*

lv7 *- Lavas of 1770-79 eruptive activity.*

lv6 *- Lavas of 1764-67 eruptive activity.*

lv5 *- Lavas (a) and scorias (b) of 1742-61 eruptive activity.*

lv4 *- Lavas of 1712-37 eruptive activity.*

lv3 *- Lavas of 1696-98 eruptive activity.*

lv2 *- Lavas of 1685-94 eruptive activity.*

lv1 *- Lavas of uncertain age forming the SW sector of the 1944 inner crater.*

MAP SYMBOLS

- Stratigraphic columns location
- Fumarole
- Quarry and dump
- Archeological site
- 79 AD — Inferred Roman Age coastline
- 4000 BP — Inferred 4500 B.P. coastline
- Lava brick bridle
- Dike
- Hot avalanche scar
- Eruptive fracture
- Vent
- Crater rim, buried (a)
- Caldera rim, buried (a)
- Scarp
- Gully
- Buried scoriae cone
- Inferred caldera of Pompei eruption
- Inferred caldera of Avellino eruption
- Inferred caldera of Mercato eruption
- Inferred caldera of Pomici di Base eruption

PHASE 3

Post caldera activity (AD 472 - AD 1631). Pyroclastic and lava activity, possibly related to the construction of a cone located inside the AD 79 caldera destroyed during the subPlinian events of Pollena, AD 472 and AD 1631.

PMX *- Pyroclastic deposits of AD 1631 eruption. Fallout and pyroclastic density current deposits of the AD 1631 subPlinian eruption. Mapped deposits are mainly related to pyroclastic density currents - PDC (mainly exposed in the W and S sectors of the volcano), because of the low thickness of the fall deposits. Fall deposits are represented by massive beds dominated at the base by tephritic-phonolitic, light coloured, pumice lapilli, and over by dark phonolitic-tephritic pumiceous to scoriaceous fragments, reaching dm-thickness in the E sector.The juvenile clasts are moderately vesicular and porphyritic, with centimetric-sized leucite crystals and minor biotite, sanidine and pyroxene. The lithics are mainly composed of lavas, cumulates, skarns (more abundant than other subPlinian eruptions). The PDC deposits consist of up to several meter-thick massive and stratified ash beds with variable content of juvenile and lithic fragments lifting pre-existing paleo-valleys. They are often capped by phreatomagmatic, fine-grained ash layers, generally containing cm-sized accretionary lapilli.* ***Age: AD 1631.***

PSP *- Lavas and pyroclastics of the activity between AD 472 and AD 1631.*
Villa Inglese Lavas (a). Lava flows erupted between the Pollena and 1631 subPlinian eruptions. Lava flows are mostly present in the W and S sectors of the volcano, being commonly covered by more recent, thin tephra falls. They are generally difficult to date both using stratigraphic markers and historical accounts. Lavas often contain phenocrysts of pyroxene and small leucite, while their composition ranges from phono-tephrite to tephri-phonolite. ***Age: AD 787 - AD 1139 (Principe et al., 2004).***
San Pietro Pyroclastics (b). Strombolian scoria-fallout deposits are exposed around some eruptive vents (Fossa Monaca and Vivit). At least another 12-13 different tephra blankets, ranging in thickness from 1 m to few cm and dispersed within 10 km from the vent, can be distinguished and related to distinct eruptive episodes. The most complete outcrop is close to Terzigno (San Pietro quarry), where the total thickness of fallout deposits is more than 9 m. Scoriaceous lapilli are typically brown to black, sometime iridescent, aphyric or sub-aphyric (pyroxene, biotite or olivine) clasts, with composition from phono-tephrite to tephri-phonolite. The only exception is represented by the juvenile fragments of the stratified deposits from the AD 512 small-scale subPlinian eruption, ranging from light brown pumice to dark brown to black, and from vesicular to dense. ***Age: BP 540 - BP 1478 (Santacroce et al., 2008).***

PPL *- Pyroclastic deposits of Pollena eruption. Fallout and PDC deposits from the Pollena subPlinian eruption. Pyroclastic fall deposits consist of eight lapilli-bearing scoria beds alternated with thinner, coarse and fine ash layers giving the total deposit a strongly stratified appearance. Scoria are rich in phenocrysts of sanidine, leucite, biotite and pyroxene. From bottom to top, the juvenile fraction varies from light to dark green and black in colour and from phono- tephrites to phonolites in composition. The density/vesicularity of clasts varies from lightmany high to highmany poor. The lithic content, mainly lava fragments and minor limestones, marbles and silvers, is generally high and increases upward. Pyroclastic flows are widely dispersed in the volcanic slopes; they consist of both massive and cross-stratified deposits reaching up to decametric-thicknesses. A peculiar flow deposit is related to the "nuée ardentelhot avalanche" phase and made of abundant, large, up to 30 cm-sized, highly vesicular and porphyritic (leucite and pyroxene) scoria.* ***Age: AD 472.***
FPL comprises the deposits of the Santa Maria cycle violent stombolian eruption, formed by an alternation of stratified fall layers of dark lapilli and brown ashes. ***Age: AD 79 - 472.***

PHASE 2

Caldera forming (22 ka - AD 79). Multiphase formation of Somma caldera related to the Plinian eruptions of Pomici di Base, Mercato, Avellino, Pompei.

PPM *- Pyroclastic deposits of Pompei eruption. Fallout and pyroclastic PDC deposits from the Pompei Plinian eruption. Pyroclastic fall deposits are composed of a lower bed layer of light-coloured, phonolitic crystal poor pumice, followed by a bed of grey phono-tephritic pumice. Grey pumice are moderately porphyritic (sanidine, pyroxene and biotite). The lithic content increases significantly from bottom (mainly lavas) to top, where skarns, marbles and carbonates are also abundant. The fallout deposit is followed by a sequence of matrix-supported, massive to cross stratified ash-rich beds representing PDC deposits of a magmatic and phreatomagmatic phase (upper phreatomagmatic deposits are distinctively lithic-rich). The deposits are dispersed throughout the volcano. A pyroclastic breccia deposit, outcropping in the SE slopes of the volcano, is coarse-grained and made of abundant, up to metric-sized lithic blocks immersed in ash and lapilli matrix.* ***Age: AD 79.***
PPM comprises deposits of the "AP" cycle subPlinian to volcanian eruptions, formed by fall layers of lapilli and ash with paleosol interlayers. ***Age: BP 2500 - BC 2170.***

PAV *- Pyroclastic deposits of Avellino eruption. Fallout and PDC deposits from the Avellino Plinian eruption. Pyroclastic falls are meter-thick deposits composed of lapilli-bearing pumice beds. The main lower bed is made up of white, porphyritic (sanidine), phonolitic, well vesicular pumice, upward passing to grey, porphyritic (sanidine and pyroxene), tephri-phonolitic pumice with variable vesicularity. The lithic component is abundant and increases from bottom (mainly lava fragments) to top (prevalent limestones as well fragments of lava, marble, intrusive rocks, skarns and cumulates). Loose crystals are common (from prevalently static at bottom to mostly ferric-upward). PDC deposits generally consist of thick surge beds with dune structures and internal cross-layering (mostly related to the phreatomagmatic phase), alternated to minor massive ash beds. They contain porphyritic white and grey pumice with phenocrysts of sanidine, pyroxene and biotite.* ***The 14C age is BP 4305 ± 40 cal y.***
PAV comprises the deposits of the Phlegrean Fields Agnano Monte Spina eruptions, and of MA1 and MA2 Vesuvius eruptions. ***Age: BP 8800 - 4305 y.***

PMR *- Pyroclastic deposits of Mercato eruption. Fallout and PDC deposits from the Mercato Plinian eruption. Pyroclastic fall deposits are composed of eight to three beds from proximal to medial-distal outcrops, which include white to light-grey, aphyric pumice. The medial-distal three beds are separated by massive, pinkish ash deposits (sometimes containing thin layers of fine lapilli); the first two beds are massive while the last one is faintly stratified and lithic-rich (leucite-bearing lava and reddish scoria fragments). Juvenile clasts are microvesicular and phonolitic (sanidine, leucite and minor pyroxene). Lithic fragments (lavas, cumulates, skarns) are abundant. The deposits are dispersed throughout the volcano (up to 20-30 m-thick), containing abundant white pumice. Lithics content increases toward the top. Deposits clearly outcrop from the NW to the E sides of the volcano.*
PMR comprises also four tephra fall deposits, one very small (VM1) and the others from the Phlegrean Fields activity (from the oldest to the youngest, VM1, Agnano Pomici Principali and VM2), all of them not mapped. ***The 14C age is BP 4305 ± 90 cal y.***

PVR *- Pyroclastic deposits of Pomici Verdoline eruption. Fallout and PDC deposits from the Pomici Verdoline subPlinian eruption. Pyroclastic fallout deposits are stratified and meter-thick and consist of grey to brown-green pumice-bearing lapilli layers and coarse ash beds. Juvenile clasts are poorly vesicular and typically aphyric or subaphyric, with rare phenocrysts of sanidine and pyroxene. Lithic fragments (lavas and carbonates) are abundant. PDC deposits consist of meter-thick ash flow beds, either massive or cross bedded, with variable content of coarse-grained juvenile and lithic material. The juvenile composition is trachitic.* ***The 14C age is BP 19265 ± 105.***

LSV *- Vallone S. Severino Lavas (a) and scorias and spatter (b).*
Vallone S. Severino Lavas (a). Lava flows related to lateralflank activity along the Vallone S. Severino-Zenillo eruptive fissure (NW sectors of the volcano). They are aphyric and poorly vesicular with latitic composition. ***Age: from 22 to 19.3 ky BP.***
Vallone S. Severino Scoriae (b). Aphyric spatter deposits of latitic composition, related to lava fountains activity from a lateral fracture located in the Vallone S. Severino-Zenillo.Other lateral cones are located in the NW sector (Vallone di Pollena) and SW sector (Camaldoli della Torre) of the volcano. ***Age: from 22 to 19.3 ky BP.***

PPB *- Pyroclastic deposits of Pomici di Base eruption. Fallout and PDC deposits from the Pomici di Base Plinian eruption. Pyroclastic fall deposits are meter-thick and composed of a basal, white ash bed, followed by a white pumice layer, including minor percentages of grey lithics (mainly lava fragments). Progressively, the juvenile clasts pass from white to grey-green pumice to grey scoriaceous pumice, composition varies from trachitic at the base to latitic at the top. The fallout sequence ends with decimetric-thick beds composed of prevalent reddish-yellowish lithics and coarse juvenile dark fragments, related to the final phreatomagmatic phase of the eruption. Pyroclastic density current deposits consist of:*
(a) meter–sized, massive ashy, surge and flow deposits related to the phreatomagmatic phase and exposed in the only N-sector of Mt. Somma. They contain white and grey-green pumice, lithics with phenocrysts of sanidine, biotite and subordinately clinopyroxene and leucite;
(b) 4 decimal thick deposits constituting dilute pyroclastic fluctuations and ash-violent coarse lithics (lava blocks) which reach the maximum thickness of 80 m close to Fosso della Vetrana. The deposits are possibly related to the eruption caldera collapse phase. ***The 14C age is BP 22.020 ± 175 cal y.***

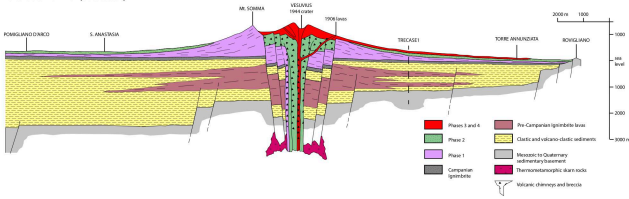
PHASE 1

Somma Stratovolcano (between 39 ka and 22 ka). Somma stratovolcano deposits overlie Campanian ignimbrite super eruption deposits in deep wells.

LSC *- Somma Lavas (a) and Cognoli Scoriae and Spatter (b).*
Somma Lavas (a). Lava flows alternating with scoria and spatter fallout beds. Lavas have composition ranging from tephrite-phonolites, to leucitite-phonolito-tephrites, K-latites and K-basalts, and variable porphyritic texture. Numerous coevol subvolcanic tabular bodies (sills, dykes) intrude the Phase 1 deposits.
They are well exposed along Somma caldera wall. ***Age: Upper Pleistocene (>39 ka and >22 ka).***
Cognoli Scoriae (b). Spatter fall beds related to Strombolian activity of lateral cones. They become more frequent at the top of the "Somma Lavas" deposits.
Age: Upper Pleistocene (>39 ka and >22 ka).

LPG *- Somma Pyroclastics. Scoria fall deposits characterised by a brownish-reddish patina alternated with lava flows. Massive ash and scoria flow deposits, containing abundant (mainly lava) lithic blocks, reaching up to 100 m of thickness at Punta del Nasone.* ***Age: Upper Pleistocene (>39 ka and >22 ka).***

GEOLOGICAL SKETCH (cross-section)



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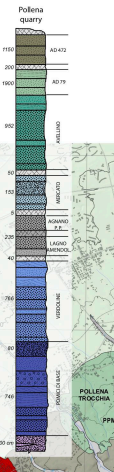

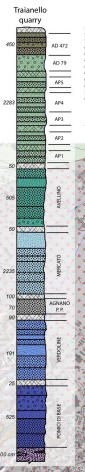

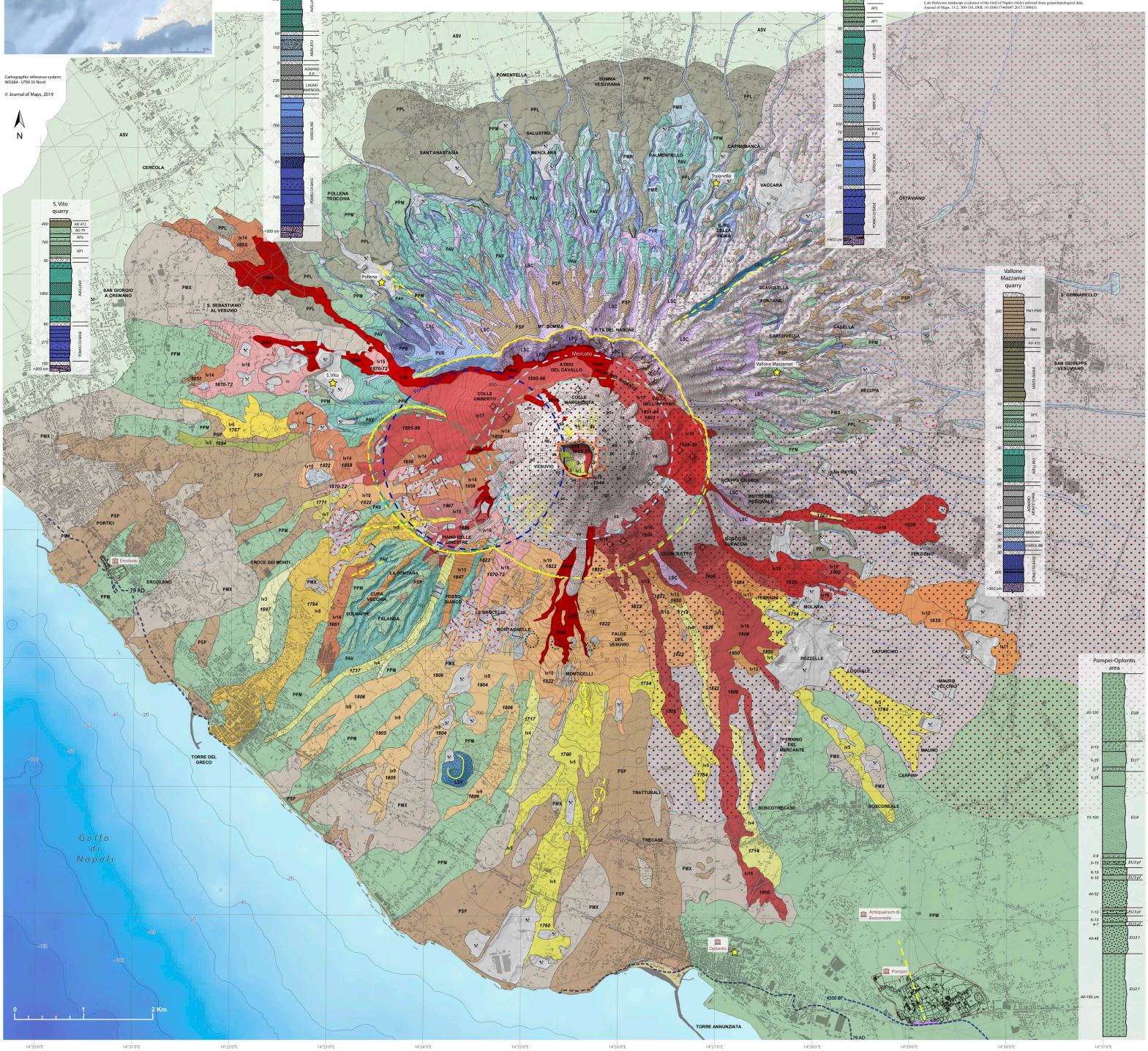

LEGEND OF STRATIGRAPHIC COLUMNS

PSP · PPL · PPM · PAV · PMR · PVR · PPB · LSC · Phlegrean Fields eruptions

Lavas · Massive ashes · Stratified ashes · Lithic lapili · Light pomiceous lapili
Welded scoriae · Cross bedded ashes and lapilli · Scoriaceous lapili · Dark pomiceous lapili · Paleosol / humified ashes

DATA SOURCE:
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