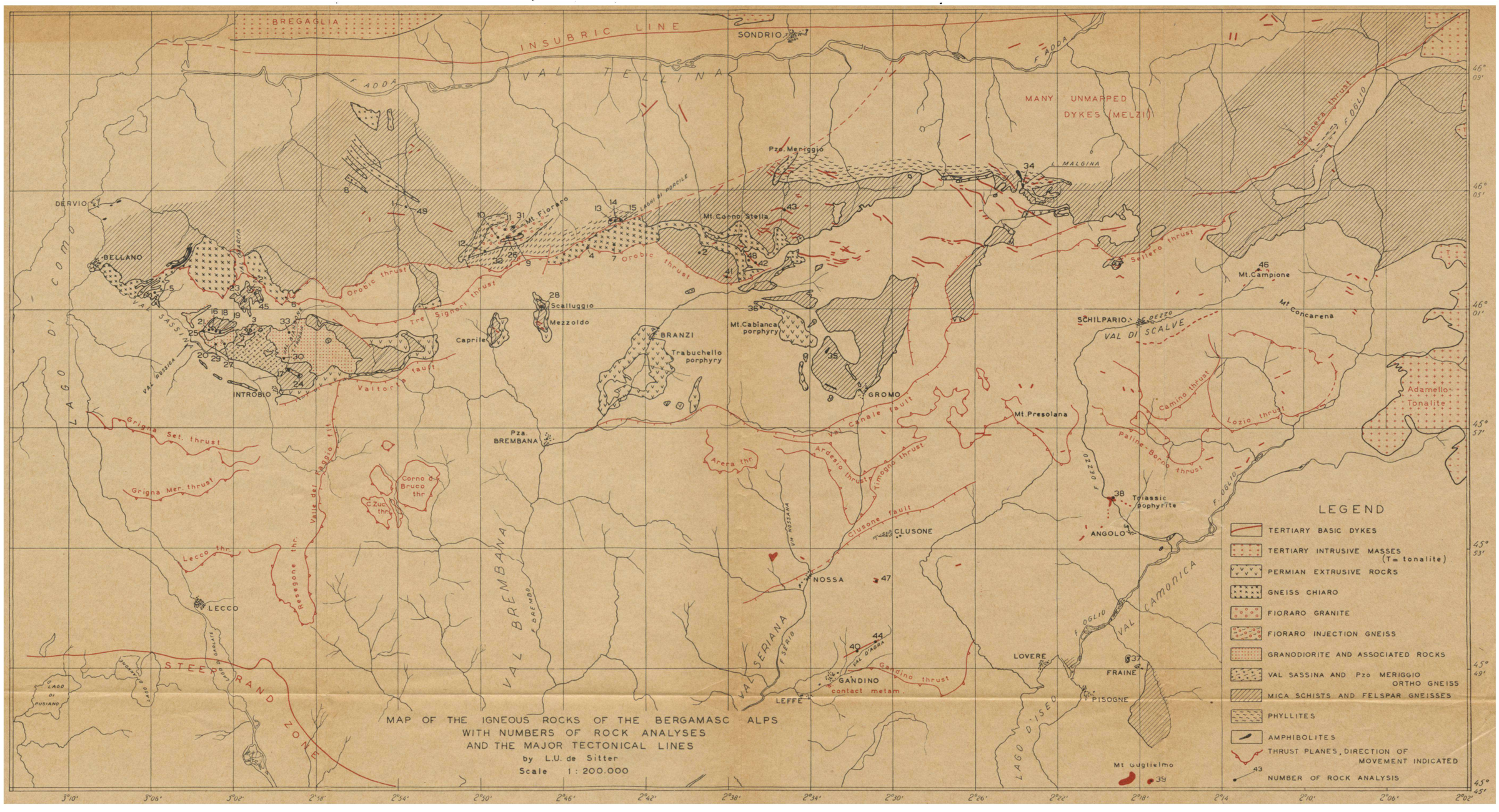
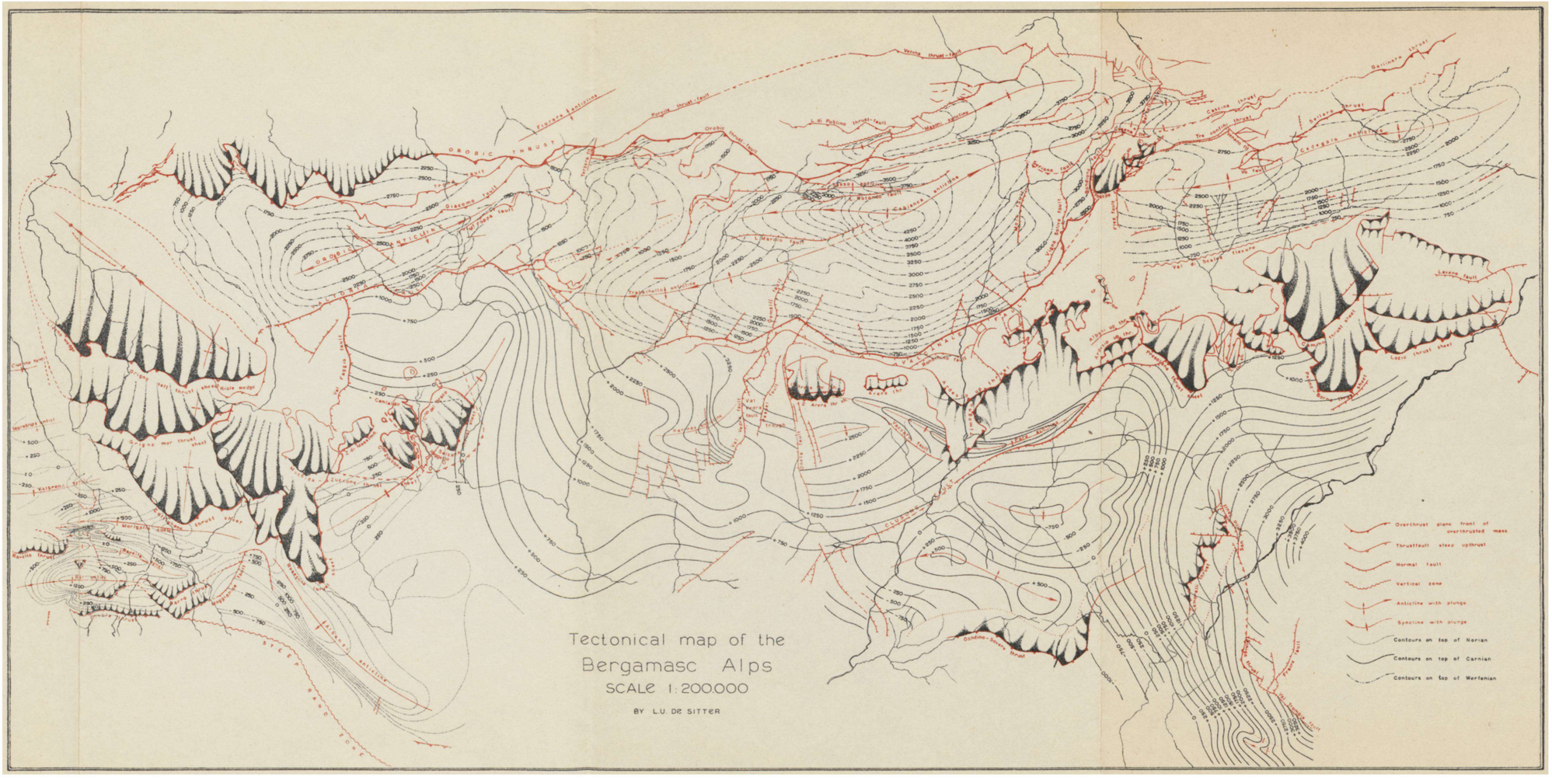
MAP OF THE IGNEOUS ROCKS OF THE BERGAMASC ALPS WITH NUMBERS OF ROCK ANALYSES AND THE MAJOR TECTONICAL LINES

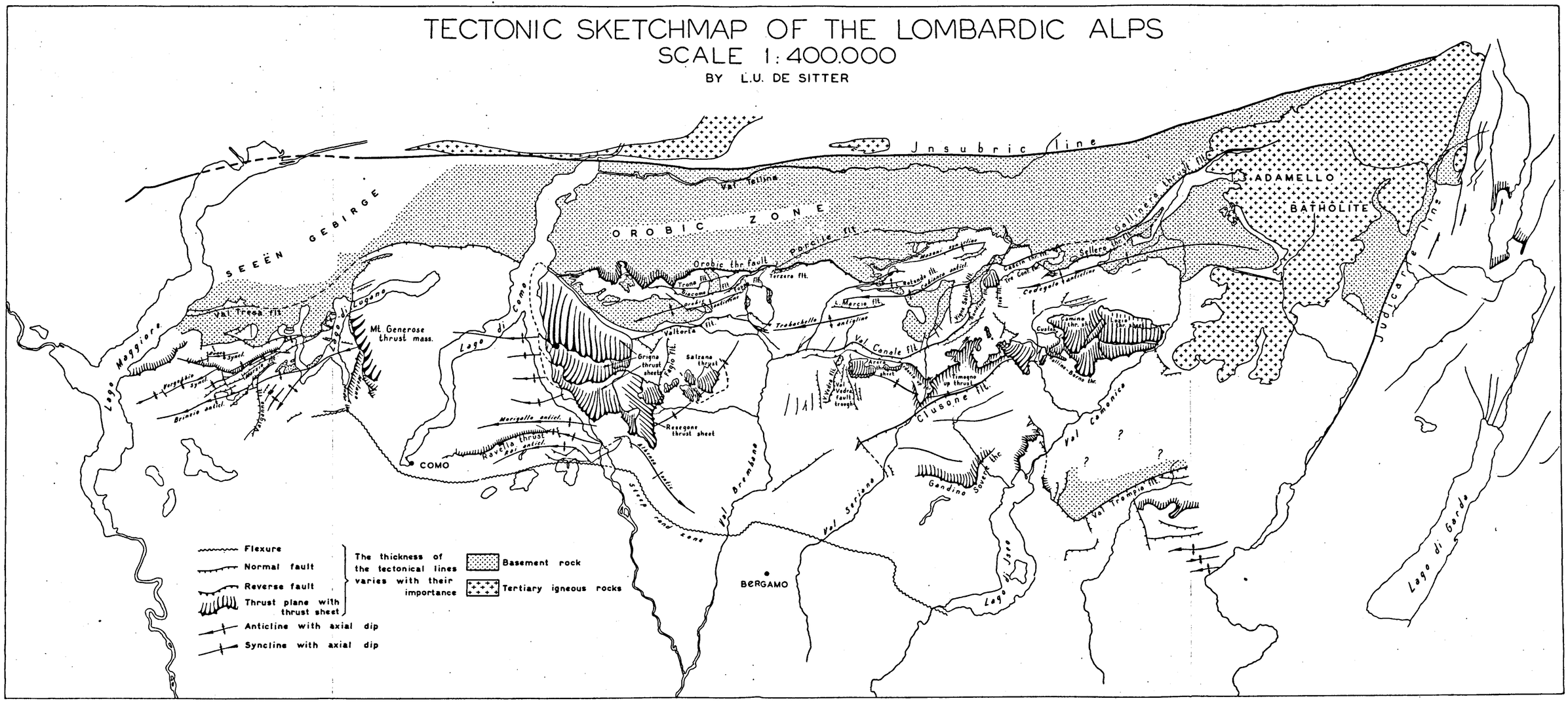


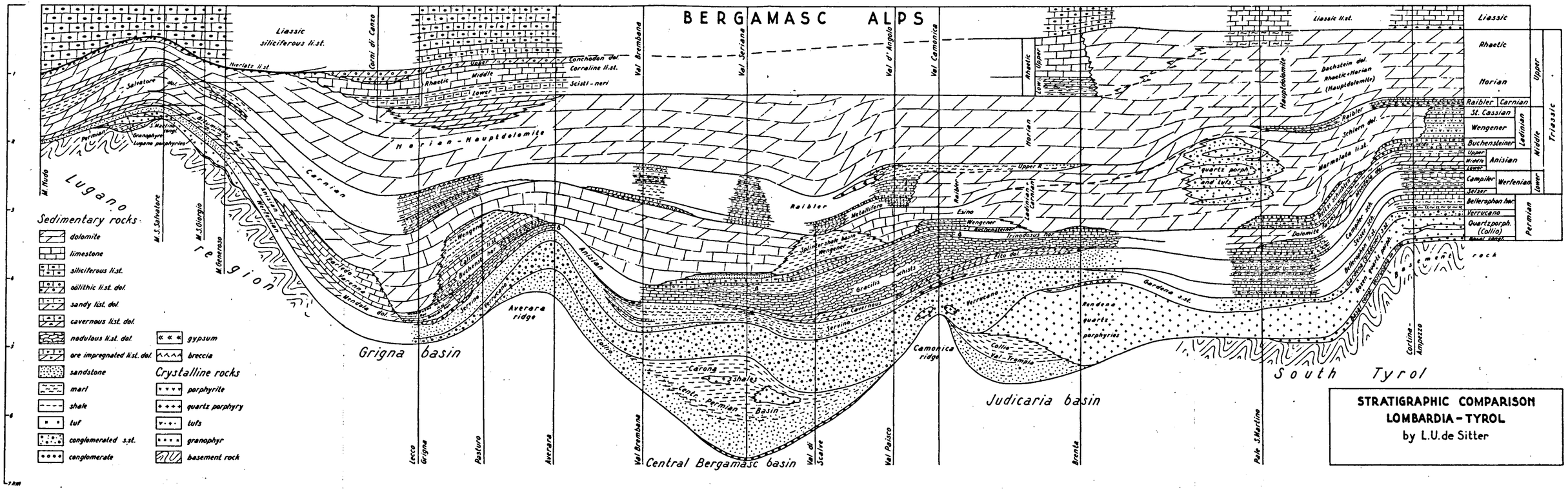

Tectonical map of the
Bergamasc Alps
SCALE 1:200.000
BY L.U. DE SITTER
Overthrust plane front of overthrusted mass
Thrustfault steep upthrust
Normal fault
Vertical zone
Anticline with plunge
Syncline with plunge
Contours on top of Norian
Contours on top of Carnian
Contours on top of Werfenian

TECTONIC SKETCHMAP OF THE LOMBARDIC ALPS

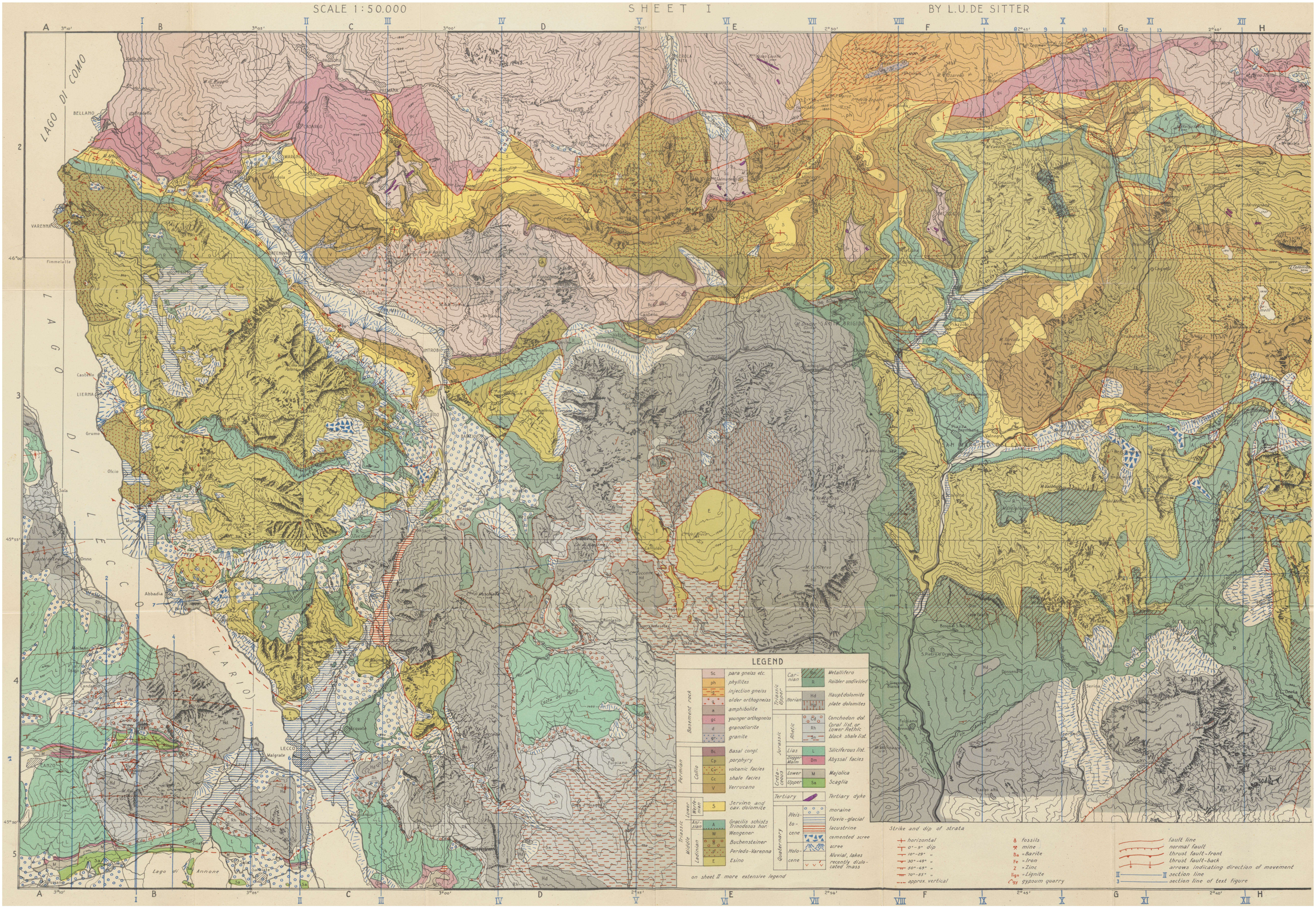
SCALE 1:400.000

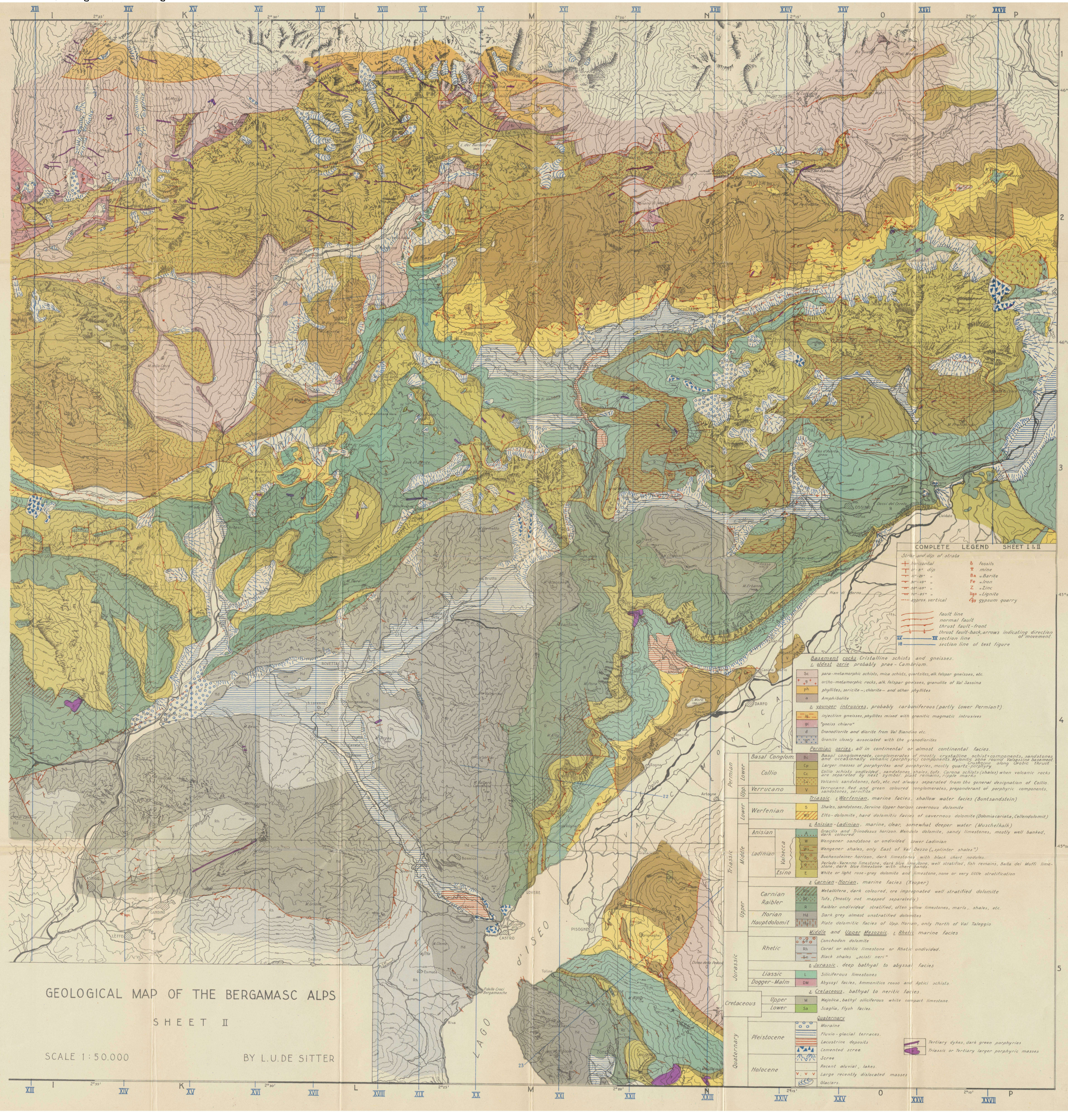
BY L.U. DE SITTER

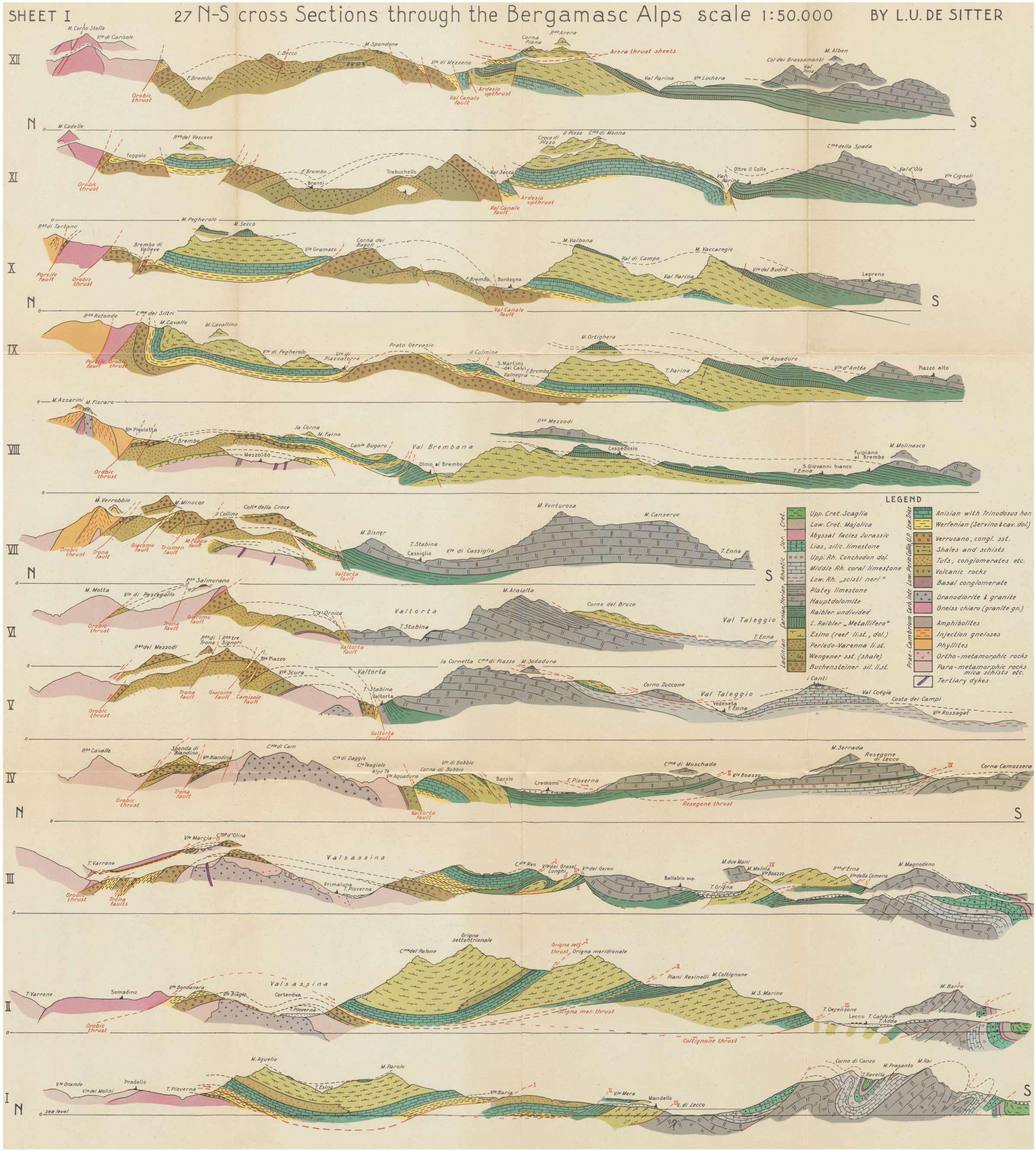


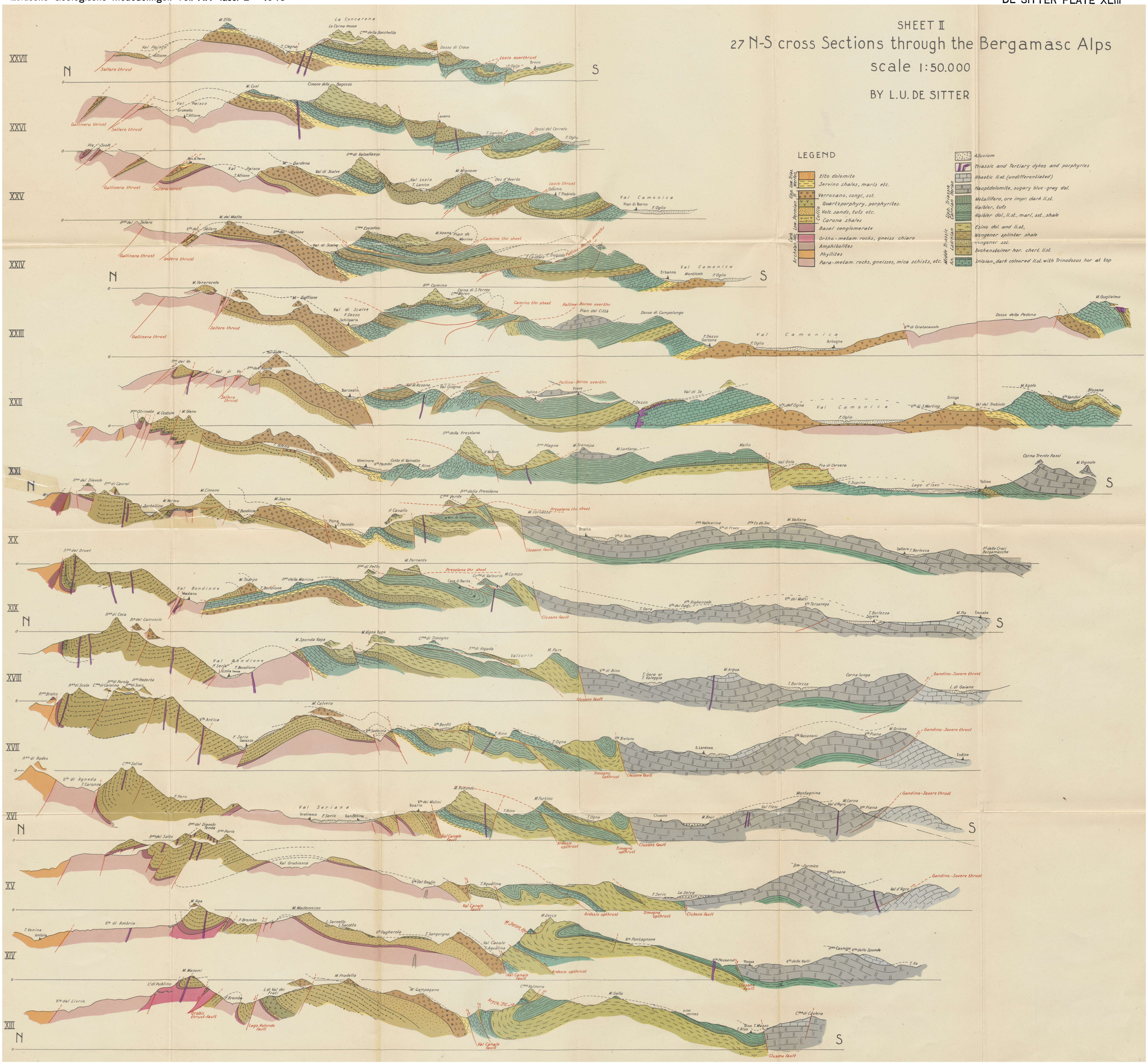

BERGAMASC ALPS
Lugano region
Grigna basin
Central Bergamasc basin
Judicaria basin
South Tyrol
Liassic siliciferous li.st.
Hierlatz li.st.
Corni di Canto
Conchodon dol.
Corralline li.st.
Scisti - neri
Rhaetic
Middle
Lower
Upper
Val Brembana
Val Seriana
Val d' Angolo
Val Camonica
Liassic li.st.
Hauptdolomite
Dachstein dol.
Rhaetic-Norian (Hauptdolomite)
Norian - Hauptdolomite
Norian
Carnian
Raibler
Schlern dol.
Marmolata li.st.
quartz porph. and tufs
Wengener
Buchensteiner
Anisian
Werfenian
Campiler
Seiser
Bellerophon lim.
Verrucano
Quartzporph. (Collio)
Permian
Triassic
Liassic
Rhaetic
Upper
Middle
Lower
Ladinian
Esino
Metallifero
Splimershalk basin
Gracilis
Cavernous
Servino
Averara ridge
Camonica ridge
Collio
Val Trompia
Rendena quartz porphyries
Gardena s.st.
Carona shales
Centr. Permian Basin
Lugano
Salvatore dol.
Permian
Grangabyr
Lugano porphyries
M. Nudo
M. S. Salvatore
M. S. Giorgio
M. Generoso
Lecco
Grigna
Pasturo
Averara
Val Brembana
Val di Scalve
Val Paisco
Brenta
Pale S. Martino
Cortina-Ampezzo
Sedimentary rocks
dolomite
limestone
siliciferous li.st.
oölithic li.st. dol.
sandy li.st. dol.
cavernous li.st. dol.
nodulous li.st. dol.
ore impregnated li.st. dol.
sandstone
marl
shale
tuf
conglomerated s.st.
conglomerate
gypsum
breccia
Crystalline rocks
porphyrite
quartz porphyry
tufs
granophyr
basement rock
STRATIGRAPHIC COMPARISON
LOMBARDIA - TYROL
by L.U. de Sitter

GEOLOGICAL MAP OF THE BERGAMASC ALPS

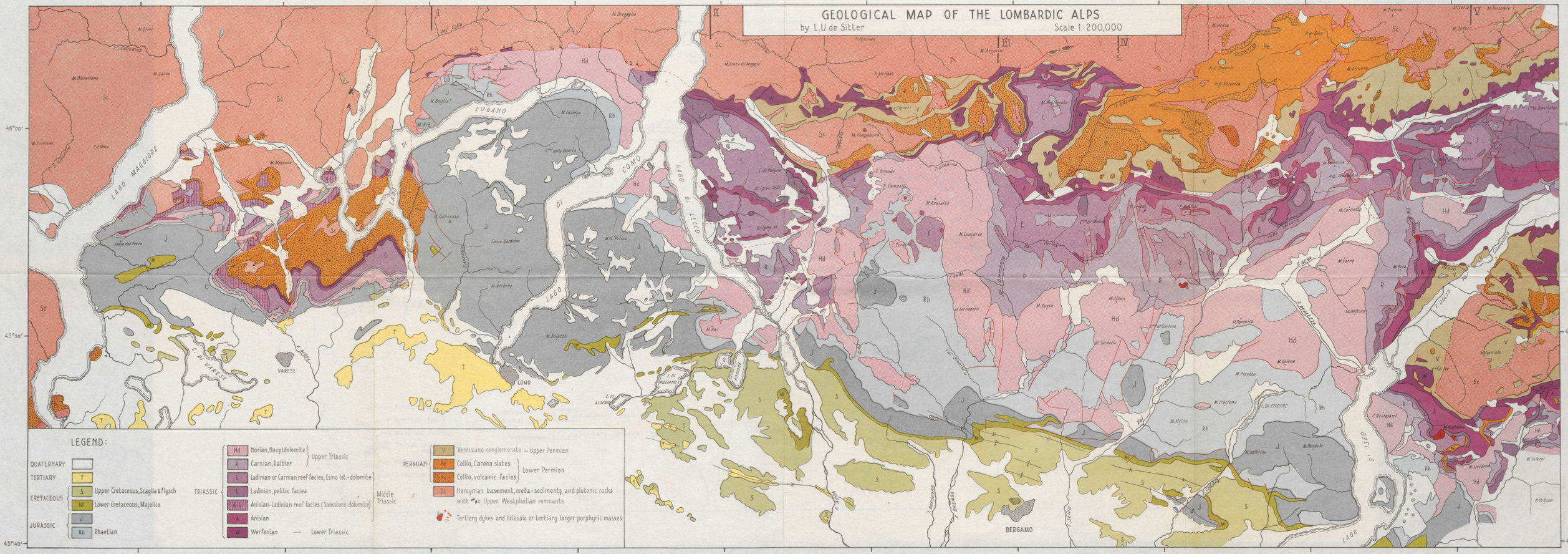



GEOLOGICAL MAP OF THE BERGAMASC ALPS
SHEET II
SCALE 1:50.000
BY L.U.DE SITTER
LAGO d'ISEO
VAL CAMONICA
COMPLETE LEGEND SHEET I & II
Strike and dip of strata
horizontal
0°-9° dip
10°-29° "
30°-49° "
50°-69° "
70°-85° "
approx. vertical
fossils
mine
Ba = Barite
Fe = Iron
Z = Zinc
lign = Lignite
gy gypsum quarry
fault line
normal fault
thrust fault-front
thrust fault-back, arrows indicating direction of movement.
section line
section line of text figure
Basement rocks. Cristalline schists and gneisses.
1. oldest serie probably prae-Cambrium.
Sc para-metamorphic schists, mica schists, quartzites, alk. felspar gneisses, etc.
g ortho-metamorphic rocks, alk. felspar gneisses, granulite of Val Sassina
ph phyllites; sericite-; chlorite- and other phyllites
a Amphibolite
2. younger intrusives, probably carboniferous (partly Lower Permian?)
ig injection gneisses, phyllites mixed with granitic magmatic intrusives
gc "gneiss chiaro"
d Granodiorite and diorite from Val Biandino etc.
gr Granite closely associated with the granodiorites
Permian series; all in continental or almost continental facies.
Permian Lower Basal Conglom. Bc Basal conglomerate, conglomerates of mostly crystalline schist-components, sandstones and occasionally volcanic (porphyric) components. Mylonitic zone round Valsassina basement. Crushzone along Orobic thrust
Collio Cp Larger masses of porphyrites and porphyries, mostly quartz-porphyry
Cc Collio schists undivided, sandstones, shales, tufs. Carona schists (shales) when volcanic rocks are separated by next symbol. plant remains, ripple marks
Cv Volcanic sandstones, tufs, etc. not always separated from the general designation of Collio.
Upp. Verrucano V Verrucano. Red and green coloured conglomerates, preponderant of porphyric components, sandstones, sernifite.
Triassic. 1. Werfenian, marine facies, shallow water facies (Buntsandstein)
Lower Werfenian S Shales, sandstones, Servino Upper horizon cavernous dolomite
WE Elto-dolomite, hard dolomitic facies of cavernous dolomite (Dolomia cariata, Cellendolomit)
2. Anisian-Ladinian, marine, clear, somewhat deeper water (Muschelkalk)
Middle Anisian A Gracilis and Trinodosus horizon. Mendelo dolomite, sandy limestones, mostly well banked, dark coloured.
Ladinian Valsecca W Wengener sandstone or undivided Lower Ladinian
Ws Wengener shales, only East of Val Dezzo („splinter shales")
B Buchensteiner horizon, dark limestones with black chert nodules.
P Perledo-Varenno limestone, dark blue limestone, well stratified, fish remains, Baita dei Muffi limestone, dark blue limestone with chert bands.
Esino E White or light rose-gray dolomite and limestone, none or very little stratification
3. Carnian-Norian, marine facies (Keuper)
Upper Carnian Raibler Rm Metallifera, dark coloured, ore impregnated well stratified dolomite
Rt Tufs, (mostly not mapped separatedly)
R Raibler undivided stratified, often yellow limestones, marls, shales, etc.
Norian Hauptdolomit Hd Dark grey almost unstratified dolomites
Hpl Plate dolomitic facies of Upp. Norian, only North of Val Taleggio
Middle and Upper Mesozoic. 1. Rhetic marine facies
Jurassic Rhetic Cd Conchodon dolomite
Rh Coral or oölitic limestone or Rhetic undivided.
Sn Black shales „scisti neri"
2. Jurassic, deep bathyal to abyssal facies
Liassic L Siliciferous limestones
Dogger-Malm DM Abyssyl facies, Ammonitico rosso and Aptici schists
3. Cretaceous, bathyal to neritic facies.
Cretaceous Upper M Majolica, bathyl siliciferous white compact limestone.
Lower Sa Scaglia, flysh facies.
Quaternary
Pleistocene Moraine
Fluvio-glacial terraces.
Lacustrine deposits
Cemented scree
Holocene Scree
Recent aluvial, lakes.
Large recently dislocated masses
Glaciers.
Tertiary dykes, dark green porphyries
Triassic or Tertiary larger porphyric masses


SHEET I
27 N-S cross Sections through the Bergamasc Alps scale 1:50.000
BY L.U. DE SITTER
XII
M. Corno Stella
Vle di Carisole
Orobic thrust
F. Brembo
L. Becco
M. Spondone
L. Gemelli
Vle di Mezzeno
Corna Piana
Pzo Arera
Arera thrust sheets
Ardesio upthrust
Val Canale fault
Val Parina
Vle Luchera
M. Alben
Col dei Brassamonti
Val Pina
N
S
XI
M. Cadelle
Pzo del Vescovo
Foppolo
Orobic thrust
F. Brembo
Branzi
Trabuchello
Val Secca
Croce di Pizzo
Il Pizzo
Cma di Menna
Ardesio upthrust
Val Canale fault
Oltre il Colle
Val Parina
Cma della Spada
Val d'Ola
Vle Cignoli
X
M. Pegherolo
Pso di Tartano
M. Secco
Brembo di Valleve
Porcile fault
Orobic thrust
Vle Gramazo
Corna dei Baggoli
M. Valbona
Val di Campo
M. Vaccaregio
Vle del Budrò
Lepreno
F. Brembo
Bordogna
Val Parina
Val Canale fault
IX
Pzo Rotondo
Cma dei Siltri
M. Cavallo
M. Cavallino
Porcile fault
Orobic thrust
Vle di Pegherolo
Vle di Piazzatorre
Prato Gervasio
il Culmine
S. Martino dei Calvi
Valnegra
F. Brembo
M. Ortighera
T. Parina
Vle Aquaduro
Vle d'Antea
Piazzo alto
VIII
M. Azzarini
M. Fioraro
Bte Pizolotta
F. Brembo
Orobic thrust
la Corna
M. Faino
Canle Bugaro
Mezzoldo
Val Brembana
Olmo al Brembo
Pzo Mezzodi
Cespedosio
S. Giovanni bianco
T. Enna
Fuipiano al Brembo
M. Molinasco
VII
M. Verrobbio
M. Minucao
Collla della Croce
il Collino
Orobic thrust
Trona fault
Giacomo fault
Triomen fault
M. Foppa fault
M. Disner
T. Stabina
Cassiglio
Vle di Cassiglio
Valtorta fault
M. Venturosa
M. Canservo
T. Enna
VI
M. Motta
Vle di Pescegallo
Pso Salmurano
Orobic thrust
Trona fault
Giacomo fault
T. di Ornica
Valtorta
T. Stabina
Valtorta fault
M. Aralalta
Corno del Bruco
Val Taleggio
T. Enna
V
Pzo del Mezzodi
Pzo di Trona
Pzo tre Signori
Bte Piazzo
Vle Scura
Orobic thrust
Trona fault
Giacomo fault
Camisolo fault
Valtorta
T. Stabina
Valtorta
Valtorta fault
la Cornetta
Cma di Piazzo
M. Sodadura
Corno Zuccone
Val Taleggio
Vedeseta
T. Enna
i Canti
Val Coégia
Costa dei Campi
Vle Rossagat
IV
Pzo Cavallo
Sponda di Biandino
Vle Biandino
Orobic thrust
Trona fault
Cma di Cam
Cle di Daggio
Cle Teagiolo
Alpe Te
Vle Aquadura
Vle di Bobbio
Corna di Bobbio
Barzio
Cremono
T. Pioverna
Valtorta fault
Cma di Muschada
II Vle Boazzo
Resegone thrust
M. Serrada
Resegone di Lecco
IV
Corna Camozzera
III
Vle Marcia
Cma d'Olina
T. Varrone
Orobic thrust
Trona faults
Valsassina
Primaluna
T. Pioverna
Csta Reo
I Vle dei Grassi Lunghi
IIa Vle del Geron
II
Ballabio sup.
M. due Mani
M. Melna
IV Vle Boazzo
T. Grigna
III
Pzo d'Erna
Vle della Comera
M. Magnodeno
II
T. Varrone
Somadino
Orobic thrust
Vle Bondanera
Vle Biagio
Valsassina
Cortenova
T. Pioverna
Grigna settentrionale
Cma del Palone
Grigna sett. thrust
I Grigna meridionale
II
Piani Resinelli
M. Coltignone
M. S. Marino
Grigna mer. thrust
Coltignone thrust
III
T. Gerenzone
Lecco
T. Caldone
T. Adda
M. Barro
I
Vle Grande
Vle dei Molini
Pradello
T. Pioverna
M. Aguelio
T. Esino
M. Parolo
Vle Baria
I
II Vle Mera
Mandello
III L. di Lecco
Corno di Canzo
M. Prazanto
M. Rai
T. Ravella
sea level
N
S
LEGEND
Cret.
Upp. Cret. Scaglia
Low. Cret. Majolica
Jur.
Abyssal facies Jurassic
Lias, silic. limestone
Rhaetic
Upp. Rh. Conchodon dol.
Middle Rh. coral limestone
Low. Rh. „scisti neri"
Norian
Platey limestone
Hauptdolomite
Carnian
Raibler undivided
L. Raibler „Metallifero"
Ladinian
Esino (reef li.st., dol.)
Perledo-Varenna li.st.
Wengener sst. (shale)
Buchensteiner sil. li.st.
Low. Trias
Anisian with Trinodosus hor.
Werfenian (Servino & cav. dol.)
U.P.
Verrucano, congl. sst.
Shales and schists
Low. Perm.
Tufs, conglomerates etc.
Carb.
Volcanic rocks
Basal conglomerate
Int.
Granodiorite & granite
Gneiss chiaro (granite gn.)
Cambrium
Amphibolites
Injection gneisses
Phyllites
Ortho-metamorphic rocks
Para-metamorphic rocks mica schists etc.
Tertiary dykes


SHEET II
27 N-S cross Sections through the Bergamasc Alps
scale 1:50.000
BY L.U. DE SITTER
LEGEND
Elto dolomite
Servino shales, marls etc.
Verrucano, congl., sst.
Quartzporphyry, porphyrites.
Volc. sands, tuffs etc.
Carona shales
Basal conglomerate
Ortho-metam. rocks, gneiss chiaro
Amphibolites
Phyllites
Para-metam. rocks, gneisses, mica schists, etc.
Alluvium
Triassic and Tertiary dykes and porphyries
Rhaetic lst. (undifferentiated)
Hauptdolomite, sugary blue-gray dol.
Metallifero, ore impr. dark lst.
Raibler, tuffs
Raibler dol., lst., marl, sst., shale
Esino dol. and lst.
Wengener splinter shale
Wengener sst.
Buchensteiner hor. chert lst.
Anisian, dark coloured lst. with Trinodosus hor at top
XXVII
XXVI
XXV
XXIV
XXIII
XXII
XXI
XX
XIX
XVIII
XVII
XVI
XV
XIV
XIII
N
S
La Concarena
Val Camonica
Lozio overthrust
Gallinera thrust
Sellero thrust
Camino thr. sheet
Palline-Borno overthr.
Presolana thr. sheet
Clusone fault
Timogno upthrust
Ardesio upthrust
Gandino-Sovere thrust
Val Seriana
Orobic thrust-fault
Lago Rotondo fault
Val Canale fault

GEOLOGICAL MAP OF THE LOMBARDIC ALPS

by L.U.de Sitter

Scale 1:200,000