The Vincent Thrust, Eastern San Gabriel Mountains, California

GEOLOGICAL SURVEY BULLETIN 1507

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By JAMES G. EVANS

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A description of constituent metamorphic rock types of the upper and lower plates

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CONTENTS

ILLUSTRATIONS

THE VINCENT THRUST, EASTERN SAN GABRIEL MOUNTAINS, CALIFORNIA

By JAMES G. EVANS

ABSTRACT

The upper plate of the Vincent thrust in the eastern San Gabriel Mountains, California, consists of Proterozoic gneiss, Triassic gneissose granodiorite, Cretaceous quartz diorite, Cretaceous or Tertiary mylonite gneiss and mylonite, and Tertiary migmatite. The lower plate is composed of the Paleocene and (or) older Pelona Schist. Quartz monzonitic rocks of Oligocene and Miocene age, as well as Cretaceous and younger andesite dikes, intrude both plates of the thrust. Petrographic and structural evidence points to an episode of mylonitization during which rocks of the upper plate underwent diaphthoresis and at least the upper part of the Pelona Schist near the Vincent thrust was deformed. The presence of amphibolite in the Pelona Schist away from the thrust suggests that the schist was metamorphosed by its great depth of burial but does not clarify whether the metamorphism was penecontemporaneous with mylonitization. Postmylonitic movement on the Vincent thrust is suggested by truncation of the mylonite zone and foliation of the mylonite by the thrust, and by the occurrence of phyllonite along the thrust.

INTRODUCTION

The Vincent thrust is exposed for 24 km in the eastern San Gabriel Mountains, California (fig. 1), between the Vincent Gap area on the west and North Fork Lytle Creek on the east; a small isolated sliver of the thrust also occurs in Middle Fork Lytle Creek. The Vincent thrust was first mapped and named by Noble (1954); part of the thrust in the San Antonio Canyon area was later studied in detail by Ehlig (1958).

The upper plate of the thrust consists of Proterozoic gneiss of the amphibolite facies, Triassic gneissose granodiorite, Cretaceous quartz diorite, Paleocene and Eocene mylonitic rocks, and Tertiary migmatite. The mylonitic rocks, mylonite gneiss, and mylonite (see terminology of Higgins, 1971) occur chiefly in a zone as thick as 900 m at the base of the upper plate. The lower plate of the thrust is the Paleocene and (or) older Pelona Schist, which is predominantly greenschist facies but also contains amphibolite-facies rocks. All these rocks are intruded by Oligocene and Miocene quartz monzonite and latite. Pegmatite dikes of quartz monzonitic composition intrude nonmylonitic rocks of the upper plate of the thrust; andesite dikes intrude nonmylonitic rocks of the upper plate and the Tertiary quartz monzonite plutons.

Many steep Tertiary and Quaternary faults cut the crystalline massif, the most important of which are the San Andreas and San Gabriel, both dextral strike-slip faults. A branch of the San Gabriel fault zone extends into the southern part of the study area (pl. 1). The Punchbowl fault zone, a splay of the San Andreas fault zone, occurs in the northern part of the area.

The entire eastern San Gabriel Mountains were greatly uplifted during the late Cenozoic.

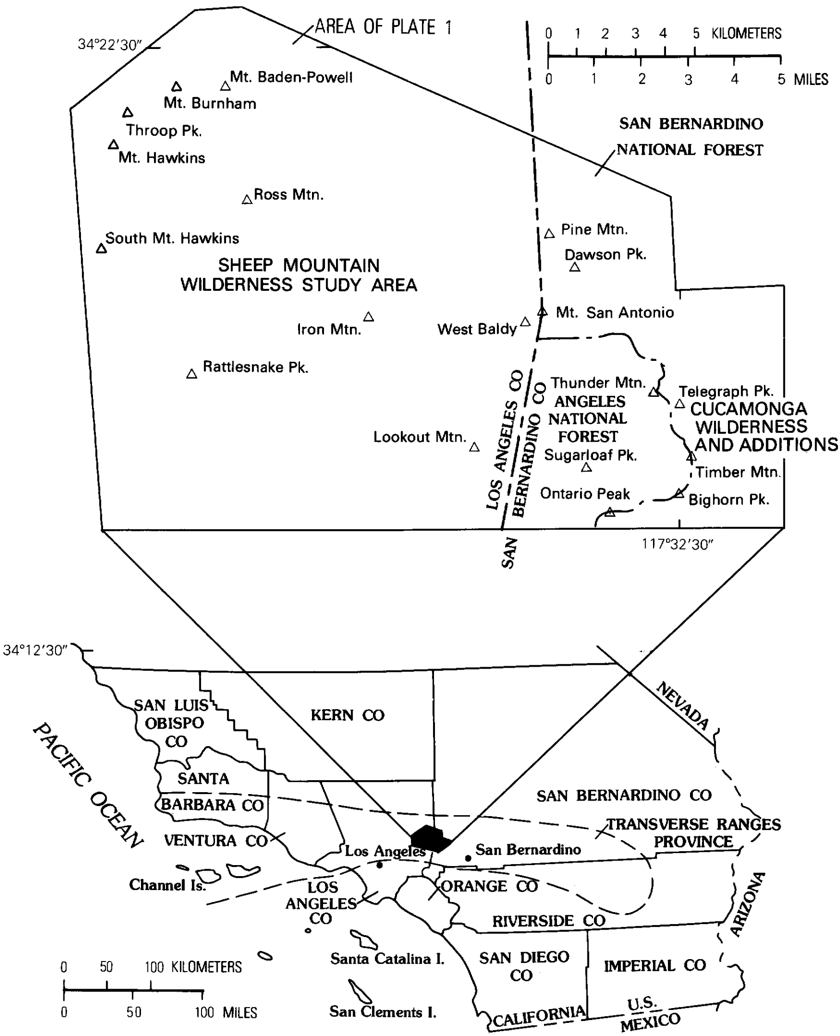

FIGURE 1.—Index map of part of eastern San Gabriel Mountains, southern California.

Acknowledgments.—I thank D. M. Morton of the U.S. Geological Survey, P. L. Ehlig of the University of California, Los Angeles, and A. K. Baird of Pomona College, Claremont, Calif., for informative discussions of the geology of the San Gabriel Mountains.

UPPER PLATE OF THE VINCENT THRUST

GNEISS

The oldest rock unit in the upper plate of the Vincent thrust is light-gray to white fine- to medium-grained banded gneiss of the amphibolite facies (pl. 1). Quartz, potassium feldspar, and plagioclase (An_{20-50}) together make up 90 percent of the rock; most of the remainder is biotite, although hornblende is locally abundant. Epidote, red garnet, pyrite, sphene, and sillimanite are minor constituents (see also Ehlig, 1958, p. 14-41). Altered gneiss is widespread, especially near major Tertiary and Quaternary high-angle faults. Feldspar in the gneiss is altered to epidote, sericite, and clay; chloritization of the mafic minerals gives the rock a greenish color; and pyrite is oxidized to hematite. The gneiss unit described here resembles gneiss of the western and central San Gabriel Mountains. The more western gneiss has yielded uranium-lead radiometric ages of 1,680 to 1,750 m.y. (Silver, 1971), that is, Proterozoic X. On the basis of its similarity to the western gneiss, the gneiss of the eastern San Gabriel Mountains is also considered to be Proterozoic X.

GNEISSOSE GRANODIORITE

Dikes of gneissose granodiorite (pl. 1), containing distinctive large (as long as 4 cm) augen of pink potassium feldspar and black hornblende phenocrysts (as long as 1 cm), intrude the Proterozoic gneiss. The granodiorite is correlative with the Mount Lowe Granodiorite of Miller (1926; 1934, p. 42-43), which has yielded a uranium-lead radiometric age of 220 ± 10 m.y. (Silver, 1971), that is, Triassic.

QUARTZ DIORITE

Medium-grained plutonic rock, ranging in composition from granodiorite to diorite but consisting mainly of quartz diorite (pl. 1), intrudes the gneiss and constitutes a large part of the migmatite units. The quartz diorite consists principally of plagioclase (An_{40-50}), quartz, hornblende, and biotite; potassium feldspar is a minor constituent, and magnetite, pyrite, sphene, and zircon are accessory minerals. Quartz diorite from Ontario Peak was dated by potassium-argon and rubidium-strontium methods (Hsu and others, 1963, p. 510) at between 80 and 115 m.y., that is, Cretaceous.

MYLONITE GNEISS

Mylonite gneiss (pl. 1) occurs principally in a zone as thick as 300 m adjacent to the gneiss near the Vincent thrust, west of Iron Mountain, and northwest of Telegraph Peak. A related occurrence is an isolated fault sliver in Middle Fork Lytle Creek. The mylonite gneiss of the San Gabriel and San Antonio fault zones is probably related to cataclasis in these two steep late Tertiary and Quaternary fault zones, and not to the Vincent thrust.

The mylonite gneiss associated with the Vincent thrust is characterized by conspicuous angular to augen-shaped feldspar porphyroclasts, from a few tenths of a millimeter to a few centimeters (max 4 cm) long, composing 30 to 40 percent of the rock. The porphyroclasts are set in a black biotite-rich groundmass. The foliation and, in places, a conspicuous lineation are defined by alinements of the porphyroclasts and by laminar concentrations of the micaceous minerals, principally biotite. Microfolds in the micaceous groundmass are common.

The feldspar porphyroclasts are mainly plagioclase (An_{20-40}); potassium feldspar, however, is an important constituent of some of the rock and forms the largest porphyroclasts. Black hornblende porphyroclasts are less common. The feldspar is partially altered to sericite and clay, and the hornblende to biotite, epidote, and hematite.

The groundmass (grains <0.1 mm) consists largely of biotite, quartz, chlorite, and white mica. In general, these minerals are intergrown, although some biotite is partially altered to chlorite. Most of the biotite exhibits well-developed strain shadows, and some showing no optical evidence of strain appears to be recrystallized. Apatite, garnet, hematite, leucoxene, magnetite, and pyrite are accessory minerals.

Subhedral to euhedral porphyroblasts of epidote and sphene, as long as 0.5 mm, occur in the rock. The epidote porphyroblasts are zoned and contain irregular brown pleochroic spots. Some epidote porphyroblasts are pseudomorphs after amphibole (hornblende?). The sphene porphyroblasts are generally elongate in the foliation, some are bent, and a few are elongate perpendicular to the foliation.

Textural gradations from banded gneiss to mylonite gneiss across a zone no wider than 3 m suggest that the mylonite gneiss was derived from the gneiss. The relatively high mafic mineral content (min 35 percent) of the mylonite gneiss further suggests that the parent gneiss was much richer in biotite than the quartzofeldspathic gneiss that composes the bulk of the nonmylonitized gneiss unit. The large porphyroclasts of potassium feldspar in the mylonite gneiss may be derived from the gneissose granodiorite.

The mylonite gneiss grades into mylonite over a zone as wide as 5 m; locally the transition is abrupt (fig. 2). The position of the mylonite gneiss—between the gneiss and mylonite—suggests that the mylonite gneiss was formed penecontemporaneously with the mylonite but under a different set of physical conditions, such as of temperature, shear stress, pore-fluid pressure, or strain rate.

MYLONITE

Mylonite (pl. 1) occurs principally in a zone 60 to 600 m thick along the base of the upper plate of the Vincent thrust. Smaller unmapped occurrences of mylonite in the San Gabriel fault zone and one occurrence on Timber Mountain (pl. 1) may be unrelated to the Vincent thrust. The mylonite unit includes protomylonite, mylonite, ultramylonite, and blastomylonite, but consists largely of mylonite (see terminology of Higgins, 1971).

Characteristically, the mylonite is very hard very fine grained gray-green, violet, and white laminated rock containing white porphyroclasts, generally smaller than 3 mm, of feldspar that constitutes 25 to 30 percent of the rock. The groundmass is aphanitic. Laminae are broadly undulating and anastomosing, and some sets of laminae cut across others at small angles.

The feldspar porphyroclasts are plagioclase (An_{20-35}) and potassium feldspar. Some feldspar porphyroclasts are partially recrystallized

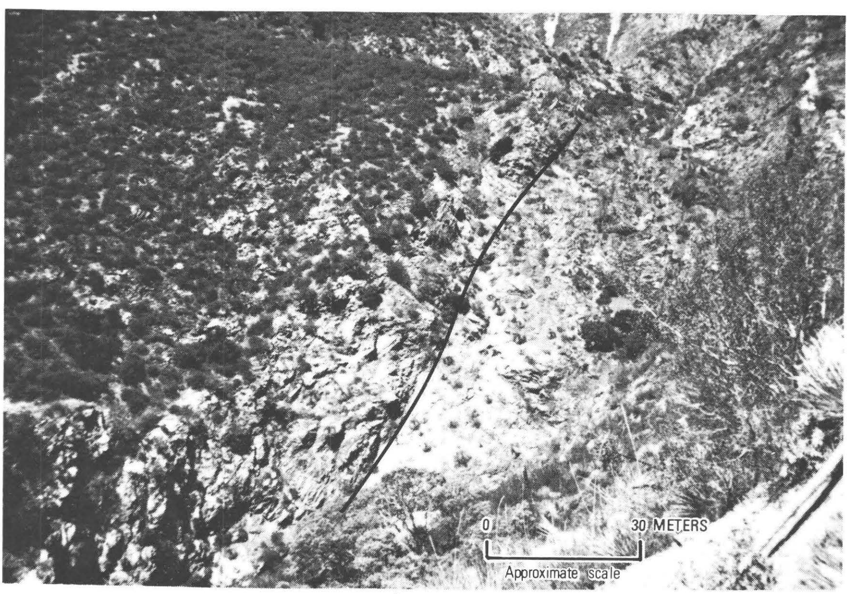

FIGURE 2.—Sharp contact between mylonite gneiss (left) and mylonite (right). View northwestward across canyon of East Fork San Gabriel River at The Narrows.

along tabular zones within the clasts and along the clast margins. A few porphyroclasts consist of intergrowths of quartz with feldspar. Much of the feldspar is altered to sericite and clay, and some is saussuritized. Black hornblende porphyroclasts, common locally in the mylonite, are partially altered to biotite, chlorite, and epidote.

The groundmass of the mylonite consists largely of quartz, chlorite, white mica, and minor amounts of biotite. The biotite is intergrown with the other micaceous minerals, although in places it is partially chloritized. Apatite, garnet, hematite, and pyrite are accessory minerals. Subhedral to euhedral porphyroblasts of epidote and sphene also occur in the mylonite, and one isolated lens of talc-specularite quartzite, 15 m thick, occurs in mylonite near the top of Iron Mountain.

The mylonite is clearly derived from the Proterozoic gneiss (fig. 3)

FIGURE 3.—Gneiss phacoid in mylonite. Hammer is 30 cm long.

and Cretaceous quartz diorite, as shown by phacoids of relatively unmylonitized gneiss and quartz diorite in the mylonite. The composition of the plagioclase porphyroclasts and the occurrence of hornblende porphyroclasts in the mylonite are consistent with such an origin.

On Iron Mountain, the presence of phacoids of medium- to coarse-grained quartz-muscovite-chlorite schist resembling the Pelona Schist (see section entitled "Lower Plate of the Vincent Thrust") in the mylonite suggests that at least some of the mylonite is derived from the Pelona Schist or from the protolith of the Pelona Schist.

The mylonite above the Vincent thrust must be Cretaceous or younger because the Cretaceous quartz diorite has been mylonitized, and must be older than Miocene because it is intruded by Oligocene and Miocene quartz monzonite (see section entitled "Rocks Younger than the Vincent Thrust"). Ehlig, Davis, and Conrad (1975) dated the mylonite at 52.7 ± 5 m.y. (Rb-Sr method), that is, Paleocene or Eocene; they considered this age to be the time of formation of the mylonite and the time of thrusting. This date falls within the Cretaceous-to-Miocene age limit for the mylonite discussed above, although this date could also be interpreted as the age of recrystallization after the shearing deformation. Therefore, the age of the mylonite is Cretaceous or Tertiary.

MIGMATITE

Tertiary migmatite occurs both west and east of the San Antonio fault (pl. 1). The migmatite west of the San Antonio fault contains rocks ranging in age from Proterozoic to Tertiary. This migmatite consists of Proterozoic X gniess intruded by numerous dikes of Cretaceous quartz diorite, Tertiary quartz monzonite, and pegmatite, as well as by less abundant dikes of latite and andesite, also of Tertiary age.

The migmatite east of the San Antonio fault contains rocks ranging in age from Paleozoic(?) to Tertiary. This migmatite consists of metasedimentary rocks intruded by numerous dikes of Cretaceous quartz diorite and Tertiary quartz monzonite. The metasedimentary rocks include dolomite marble, calcite marble, argillite, carbonaceous and pyritiferous metasiltstone, graphite schist, quartzite, biotite gneiss, and layered calc-silicate rocks containing laminations of pink garnet, green pyroxene, and white calcic plagioclase. Ehlig (1958, p. 50-73), who described these rocks in detail, concluded that the metasedimentary rocks are most likely no younger than Paleozoic because of their gross lithologic similarity to Carboniferous rocks of the Mojave Desert and San Bernardino Mountains. The metasedimentary rocks also resemble the Placerita Formation of Miller (1934) in the San Fernando quadrangle 50 km to the west (Oakeshott, 1958).

Limestone of the Placerita Formation has been tentatively correlated on a lithologic basis with upper Paleozoic limestone in the San Bernardino Mountains (Miller, 1946, p. 468; Baird, 1956; Ehlig, 1958; Oakeshott, 1958, p. 52; Woodford, 1960, p. 403; Stewart and Poole, 1975). Therefore, the lithologic similarities of metasedimentary rocks of the eastern San Gabriel Mountains to other rocks in the area suggest that the metasedimentary rocks are Paleozoic, although an older age cannot be ruled out.

METAMORPHISM OF THE MYLONITIC ROCKS

Diaphthoresis is prominent in the mylonite gneiss and in the mylonite; feldspar is altered to epidote, sericite, and clay, hornblende to epidote, chlorite, and hematite, and biotite to chlorite. In addition, the biotite, epidote, and sphene show evidence that recrystallization followed mylonization: epidote and sphene occur as porphyroblasts, and some grains of biotite lack extinction shadows. The intergrowth of biotite with chlorite in some rocks suggests that the temperatures at some time during mylonitization were in the range characteristic of greenschist facies. These observations and conclusions generally accord with those of Ehlig (1958, p. 144-152).

THE VINCENT THRUST

The Vincent thrust is an irregular fault surface having a local relief of as much as 1 m at the base of the associated mylonite. The thrust is marked in places by a zone of crumbly silvery-gray-green chlorite and chlorite-talc phyllonite as thick as 1.5 m (fig. 4). The phyllonite exhibits anastomosing foliation and numerous microfolds. This distinctive rock lies in sharp contact with the overlying mylonite and the underlying Pelona Schist. Where the phyllonite is absent, the mylonite is in sharp contact with the Pelona Schist.

LOWER PLATE OF THE VINCENT THRUST

PELONA SCHIST

The Pelona Schist is typically a fine-grained silvery-gray muscovite-albite-quartz schist. Albite occurs as porphyroclasts, generally about 1 mm in diameter and commonly gray to black, that contain graphite inclusions. Potassium feldspar is a minor constituent in some of the schists, along with calcite, pink garnet, hematite, leucoxene, and pyrite.

Fine- to medium-grained green chlorite-actinolite schist composes less than 5 percent of the Pelona Schist. Chlorite-actinolite schist, the second most abundant rock type in the unit, is most common just below the Vincent thrust. This schist contains abundant green epidote porphyroblasts, as well as white albite porphyroblasts containing minute inclusions of actinolite. These porphyroblasts are commonly 1 mm in diameter; however, at The Narrows just below the Vincent thrust, a greenschist layer contains porphyroblasts as long as 5 mm. Allanite, blue-green hornblende, muscovite, pyrite, quartz, sphene, and tremolite are accessory minerals.

FIGURE 4.—Vincent thrust at The Narrows, East Fork San Gabriel River. Thrust contact is between mylonite (right) and Pelona Schist (left). Phyllonite occurs along thrust. View eastward.

Other minor rock types in the Pelona Schist, listed in the order of diminishing abundance, are: dark-gray to black quartzite (metachert), commonly associated with the chlorite-actinolite schist; calcareous quartzite containing stilpnomelane; coarse-grained green actinolite-talc rock; layered pink and white piedmontite-alurgite quartzite; black hornblende schist; and layered black and white amphibolite containing red garnet porphyroblasts as large as 2 mm across. The last three rock types were not found in place, but their presence was inferred from cobbles in streams in the north-central part of the study area. The hornblende schist and amphibolite are also inferred to occur on the lower slopes of Blue Ridge, northeast of the Punchbowl fault zone, because these rock types were not evident in better exposed areas on the crest of Blue Ridge or south of the Punchbowl fault zone.

Most of the Pelona Schist is clearly in the greenschist facies. The presence of hornblende schist and amphibolite indicates that part of the Pelona Schist attained the amphibolite facies. A detailed description of part of the Pelona Schist in the Mount Baldy-San Antonio Canyon area was given by Ehlig (1958, p. 83-125).

The Pelona Schist has been generally assigned a Precambrian or Precambrian(?) age (Hershey, 1902, p. 273; Hulin, 1925, p. 29-30; Simpson, 1934, p. 380-381; Clements, 1937, p. 231; Miller, 1946, p. 468; Wallace, 1949, p. 787; Dibblee, 1967, p. 9). Ehlig (1958, p. 133-140; 1968), however, proposed that the age of metamorphism of the schist is Cretaceous and that the protolith of the schist may have been deposited during the Mesozoic. Near North Fork Lytle Creek the Pelona Schist is intruded by quartz monzonite yielding a potassium-argon age of 13.4 to 20.2 m.y. (Miller and Morton, 1977, p. 647), that is, Miocene; the metamorphic age of the Pelona must, therefore, be older than this quartz monzonite.

Muscovite-albite-quartz schist of the Pelona from the San Gabriel Mountains was dated, using the whole-rock potassium-argon method, at 52.4±1.0 m.y. (Eocene) by Ehlig (1975, p. 183) and Ehlig, Davis, and Conrad (1975); they interpreted this date as a cooling date after metamorphism. Metachert from the Pelona Schist near the Vincent thrust yielded a whole-rock rubidium-strontium age of 59±1 m.y. (Gary Lass, written commun., 1977), that is, Paleocene. This age is consistent with that on the mylonite and is consistent with Ehlig's (1958, p. 163) hypothesis that metamorphism of the Pelona and mylonitization were contemporaneous. This Paleocene date, however, could reflect an episode of recrystallization late in the development of the schist, and so the metamorphic age of the Pelona away from the Vincent thrust could be older than Paleocene. The metamorphic age of the Pelona Schist is clearly older than the Miocene quartz monzonite (possibly Paleocene) but could be even older. Evans and others (1977), in a study of mineral resources of the Sheep Mountain Wilderness area, considered the Pelona Schist to be Cretaceous or older. With further study of the radiometric dates and of relations of the Pelona to other units, however, the metamorphic age of the Pelona Schist is now considered to be Paleocene and (or) older.

ROCKS YOUNGER THAN THE VINCENT THRUST

QUARTZ MONZONITE

Three textural varieties of quartz monzonitic rock occur in the eastern San Gabriel Mountains: equigranular and porphyritic quartz monzonite (pl. 1), aphanitic and porphyritic latite, and pegmatite (latite and pegmatite dikes are too small to map). The quartz monzonite and latite intrude gneiss, metasedimentary rocks, quartz diorite, the mylonitic rocks, and the Pelona Schist. The pegmatite intrudes gneiss, quartz diorite, and the quartz monzonite west of San Antonio Canyon. Although pegmatite intrudes the quartz monzonite, its compositional similarity to the quartz monzonite host and, in places, its textural gradations from pegmatite to quartz monzonite suggest that the pegmatite is a late-stage differentiate of the quartz monzonite.

Hsu, Edwards, and McLaughlin (1963) dated quartz monzonite from the Telegraph Peak area and obtained a wide spread of values by the potassium-argon (17±5 m.y. and 26±3 m.y.) and rubidium-strontium (25±15 m.y. and 19±15 m.y.) methods. Miller and Morton (1977) dated granodioritic rocks (included in quartz monzonite unit, pl. 1) that intrude the Pelona Schist and the Vincent thrust near North Fork Lytle Creek at about 14 m.y. (K-Ar method). They also dated rocks in the chilled margin of the pluton at 18.6±0.6 m.y. and suggested that this age could reflect retention of argon by partially assimilated biotite from the host rock or could represent the time of emplacement. Miller and Morton also redated the quartz monzonite that had been dated by Hsu, Edwards, and McLaughlin (1963) and obtained potassium-argon dates ranging from 19.4 to 24.1 m.y. The dates obtained by Miller and Morton on the quartz monzonite unit (pl. 1) range from 13.4 to 24.1 m.y., that is, latest Oligocene to middle Miocene.

ANDESITE

Three kinds of andesite dikes (too small to map) intruding gneiss, quartz diorite, the Pelona Schist, and quartz monzonite make up less than 5 percent of the migmatite west of the San Antonio fault. The dikes consist of: (1) dark andesite porphyry ranging in composition from andesite to latite, (2) gray andesite containing conspicuous black hornblende phenocrysts (hornblende porphyry), and (3) dark-gray andesite containing conspicuous white plagioclase phenocrysts as long as 1 cm. The relative ages of these three kinds of dikes are poorly known. The hornblende porphyry intrudes the fine-grained dark andesite porphyry, and so the hornblende porphyry must be the younger of the two; the andesite dikes are Cretaceous or younger because they commonly intrude the quartz diorite. Some andesite dikes intrude the quartz monzonite, and so these dikes must be younger than Oligocene.

PUNCHBOWL FAULT ZONE FAULT BRECCIA

The Punchbowl fault zone, a 60- to 1,200-m-wide splay of the San Andreas fault, cuts the Vincent thrust in the northwest corner of the study area. The fault zone contains fault breccia and large blocks several hundred meters long of many rock types, including gneiss, the Pelona Schist (greenschist-facies type), quartz diorite, mylonite like that above the Vincent thrust, red arkose, and red arkosic boulder conglomerate. The sedimentary rock is probably derived from the upper Miocene and lower Pliocene Punchbowl Formation. The Punchbowl fault zone was active during the late Pliocene or Pleistocene (Dibble, 1968, p. 264).

DISCUSSION

According to the model proposed by Ehlig (1958, p. 163, 164; 1968), the protolith of the Pelona Schist was heated to metamorphic temperatures by the combined effects of deep burial, frictional heating along the Vincent thrust, and heat transported from the upper plate of the thrust as the plate rose from a relatively hotter environment. As a result, the protolith was metamorphosed to greenschist facies, and rocks at the base of the upper plate of the thrust were mylonitized and retrometamorphosed from amphibolite to greenschist facies. Ehlig's evidence supporting this model includes: petrographic evidence of greenschist metamorphic grade in the Pelona Schist and diaphthoresis to greenschist facies in the mylonitic rocks; subparallelism of several prominent synmetamorphic foliations and lineations in mylonite and in the Pelona Schist near the Vincent thrust; increase in metamorphic grain size in the Pelona Schist toward the thrust; and increase in the intensity of deformation of the Pelona Schist toward the thrust.

Increase in grain size and in intensity of deformation of the Pelona Schist toward the Vincent thrust were not observed during the present study. One layer of greenschist near the Vincent thrust at The

Narrows was observed to contain albite and epidote porphyroblasts as long as 5 mm. Other schist nearby, however, exhibited albite porphyroblasts 1 mm across, typical of the Pelona Schist.

In general, the evidence appears convincing that the mylonitic rocks and at least part of the Pelona Schist near the Vincent thrust were altered during a tectonic episode characterized by temperatures in the greenschist facies and intense shearing. However, the evidence does not clearly indicate that the entire Pelona Schist was metamorphosed during this episode, as the thrust model proposes.

The model does not take into account the occurrence of amphibolite-facies rocks within the Pelona Schist away from the Vincent thrust. In the schematic cross section of the Blue Ridge-Pine Mountain-Iron Mountain area (fig. 5), the inferred position of the amphibolite-facies rocks several hundred meters below the Vincent thrust does not suggest any connection between metamorphism of the Pelona Schist and faulting on the Vincent thrust. Consequently, frictional heating along the thrust and superposition of relatively warm upper-plate rocks must have had little effect on the formation of amphibolite in the protolith of the Pelona Schist. The metamorphic temperatures in the protolith were most likely due to great depth of burial that could be related to the episode of thrusting and mylonitization, or to an earlier period. Phacoids of schist like the Pelona in the mylonite do not clearly establish whether the protolith or the fully developed schist was overridden by the Vincent thrust.

Postmylonitization movement on the Vincent thrust is suggested by three lines of evidence. (1) The mylonite zone above the Vincent thrust ranges from 60 to 600 m in thickness, varies abruptly, and appears to be truncated by the thrust. (2) Prominent foliations in the mylonite are truncated by the thrust, especially in the Mount Baden-Powell and Iron Mountain areas (cross sec. *A*-*A*′, pl. 1). (3) The crumbly phyllonite along the thrust differs distinctly from the schist and mylonite that compose the two plates of the thrust. The phyllonite

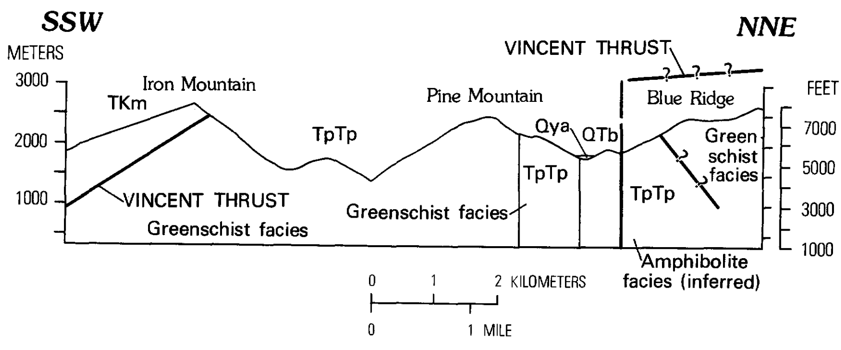

FIGURE 5.—Schematic cross section of Blue Ridge-Iron Mountain area.

would be unlikely to form in a dynamothermal environment where either mylonite or schist was formed in adjacent rock. The phyllonite, however, could have formed along the Vincent thrust after mylonitization; temperatures along the thrust may then have been lower than during mylonitization, and strain was probably localized along the thrust.

SUMMARY

(1) A tectonic episode in which the mylonitic rocks and the Vincent thrust were formed and at least the upper part of the Pelona Schist was deformed can be postulated for the eastern San Gabriel Mountains. The deformation near the thrust within a temperature range characteristic of greenschist facies caused the amphibolite-facies gneiss and quartz diorite of the upper plate to undergo diaphthoresis.

(2) The occurrence of amphibolite in the Pelona Schist and the inferred position of the amphibolite several hundred meters below the Vincent thrust suggest that metamorphic temperatures in most of the schist were due to great depth of burial. The evidence does not clearly indicate whether this burial occurred during the major thrusting and mylonitization, or before that episode.

(3) Movement along the Vincent thrust after the episode of major thrusting and mylonitization is suggested by truncation of the mylonite zone and of foliation in the mylonite by the thrust, and by the occurrence of distinctive crumbly phyllonite along the thrust.

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