

STRATIGRAPHY OF THE CHUACÚS GROUP ON THE SOUTH SIDE OF THE SIERRA DE LAS MINAS RANGE, GUATEMALA

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ABSTRACT

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The Chuacús Group is a complex of metamorphic rocks in an east-west belt along the Central America Cordillera between the Chixoy-Philochic fault zone to the north and the Motagua fault zone to the south.

Newcomb (1975) proposed a stratigraphy for the middle and eastern portions of the Sierra de las Minas range. This investigation attempts to extend that stratigraphy to the western end of the range. To achieve this, some of the formations proposed by Newcomb must be modified, and at least one new formation is introduced.

Newcomb's San Agustín Formation is the lowest unit of the Chuacús Group and has not been recognized in the western end of the Sierra de las Minas range. In El Progreso quadrangle several major modifications are needed for the overlying Jones Formation. The mafic composition of this unit may in part be due to metasomatism during Mesozoic to Tertiary serpentinite emplacement. A hornblende gneiss occurs in the lower part of this sequence.

INTRODUCTION

The Central American Cordillera forms an arcuate shaped series of mountain ranges through southern Guatemala. These ranges are composed predominantly of metamorphic rocks (Fig. 1). This metamorphic assemblage was first described by DOLLFUS & DE MONTERRAT (1868), and later delineated on a general regional scale by SAPPER (1899). MCBIRNEY (1963) named these rocks the Chuacús Series from exposures in the Sierra de Chuacús. KESLER ET AL. (1974) proposed that the Chuacús be changed to group status, and recognized several formations in Western Guatemala. They also proposed that the Chuacús Group is a belt of basement rock that extends east-west across Guatemala, and is bounded on the north by the Chixoy-Polochic fault zone, and on the south by the Motagua fault zone.

The age of the Chuacús Group is controversial. Radiometric ages range from Precambrian (GOMBERG ET AL., 1968) to Tertiary (MCBIRNEY & BASS, 1969; WILLIAMS & MCBIRNEY, 1969; BOSCH, 1971). The most acceptable dates are middle Paleozoic

(GOMBERG ET AL., 1968; PUSHKAR, 1968), because the Precambrian date was obtained from partially recrystallized zircons, and the Chuacús Group is known to underlie the Santa Rosa and Chochal formations, the latter of which is Permian in age (MCBIRNEY, 1963; VANDEN BOOM, 1972). Thus, the Chuacús is at least pre-late Paleozoic in age, and has been significantly overprinted by later tectonic events during the Mesozoic and Cenozoic.

The purpose of this paper is to propose a stratigraphic sequence in the Chuacús Group in the Sierra de las Minas range on the eastern side of this metamorphic belt. The four 10 × 15 minute quadrangles used in this regional interpretation are delineated in figure 1. A synthesis of this mapping is presented in figure 2.

ROPER (1973, 1976) proposed several lithologic subdivisions of the Chuacús Group in the western part of the Sierra de las Minas range, but referred to them only by rock type. It was BOSCH (1971), and particularly NEWCOMB (1975) who proposed specific formation names for several distinct lithologies in the Chuacús Group in this region. Therefore, it is important to correlate these formations in the middle and eastern part of the range with those at the southwestern part of the Sierra de las Minas. If correlation of NEWCOMB's (1975) units can be

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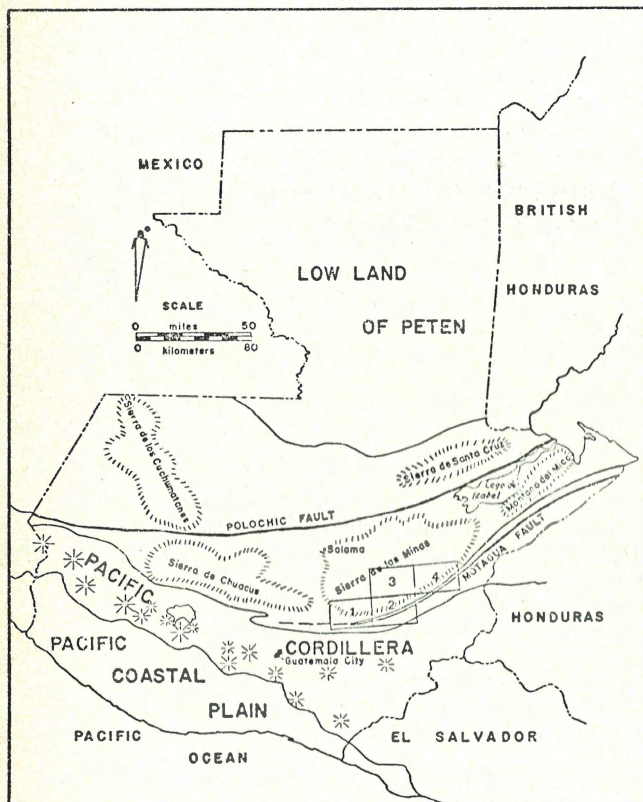


Fig. 1
Map showing physiographic provinces of Guatemala, and the location of the region mapped along the Sierra de las Minas range.

extended to El Progreso quadrangle then a recognizable stratigraphy for about three-fourths of the Sierra de las Minas range will be accomplished. The establishment of a stratigraphic section in this area will also make it possible to understand the Mesozoic and Cenozoic tectonic overprinting better on these rocks. NEWCOMB's (1975) formation names will be adopted. However, it will be demonstrated that his sequence of units is not complete, and the stratigraphic sequence that he proposed needs to be modified in order to be applied effectively to the western end of the Sierra de las Minas range.

FORMATIONS OF THE CHUACÚS GROUP

San Agustín Formation

NEWCOMB (1975) proposed that the San Agustín Formation is the lowest unit of the Chuacús Group. It is found only east of El Progreso quadrangle (Fig. 2), and consists of various kinds of cataclastic gneissic rocks, and a distinct zone of migmatites. One of the most characteristic features of this formation is its cataclastic texture, which according to NEWCOMB (1975) increases toward the Motagua fault zone in the

south, suggesting that some of this texture is related to movement along that zone. These rocks are mineralogically unique in the Chuacús Group in that they contain abundant microcline in the form of perthite. NEWCOMB (1975) has also shown from chemical analysis that these rocks are distinct in the Chuacús sequence in that they contain higher quantities of silica and alkalis, and fall in the chemical range of monzonite and quartz monzonite. He interpreted these rocks to be metaigneous, and suggested that they represent the basement of the Central Cordillera. No information in El Progreso quadrangle conflicts with this interpretation, and the San Agustín Formation is acknowledged as the lowest Formation in the Chuacús Group recognized at this time. However, its position as fundamental basement remains to be proven.

Jones Formation and related units

Conformably overlying the San Agustín Formation is a complex sequence of metasedimentary units. The metasedimentary nature of these rocks is indicated by carbonates, lens of quartzite, and chemical compositions of mica schist determined by NEWCOMB (1975) which are similar to average pelitic rocks determined by SHAW (1965).

The lowest, most extensive and most complex of these units is the Jones Formation (Fig. 2). NEWCOMB (1975) suggested that these rocks change in composition along strike. In the Río Hondo quadrangle they are characterized by dark gray banded phyllites which in places are associated with a dirty high-calcium marble and fine-grained amphibolitic greenstones. Farther to the southwest in the San Agustín Acasaguastlán quadrangle these rocks gradually change to mica schist and minor quantities of amphibolite and marble. The sequence continues through El Progreso quadrangle with the addition of some micaceous gneiss, and was designated as C_2 and C_3 by ROPER (1976). However, ROPER (1973) indicated that the tremolitic amphibolites in this region are the result of serpentinite emplacement (M_2 metamorphism and metasomatism) during the Mesozoic and Tertiary and are not part of the original Jones Formation. The large quantities of serpentinite and their structural relationships in the San Agustín quadrangle are similar to those in El Progreso quadrangle. This leads the author to suspect that the tremolite that NEWCOMB (1975) found in this formation may be a secondary metamorphic overprint on an older Jones Formation lithology. This interpretation is supported by numerous photomicrographs illustrating the relationship of polymetamorphism by NEWCOMB (1975) in Jones Formation lithologies. If this interpretation is correct, then the geochemical characteristics of these rocks which are stated by NEWCOMB (1975) to be lower in SiO_2 , CaO , Na_2O , and K_2O , but higher in TiO_2 , Al_2O_3 , total Fe_3O_4 and MgO than other Chuacús formations will necessitate some modification, especially with regard to the high iron and magnesium content. The Jones Formation in the northeastern part of El Progreso quadrangle is unique in that much of the mica schist and gneiss contains numerous small intrusive peg-

EXPLANATION

- | | | | | |
|----------------|------|---|---|--|
| Quaternary | Qav | Alluvium & volcanic ash undifferentiated | --- | Lithologic contact; dashed where inferred |
| | Qb | Basalt | - - - - -
d | Fault; dashed where inferred; dotted where concealed |
| Cret.-Tertiary | Tg | Guastatoya fm; sandstone and conglomerate of tuffaceous and pyroclastic character | ↗ ↘ | Thrust fault; dashed where inferred; teeth on head wall |
| | KTsb | Subinal fm, red shale & sandstone, conglomerate with limestone & serpentinite cobbles | ⊕ ⊖ | Post F ₁ fold axis |
| | AP | Amphibolite and phyllite | [Diagonal lines] | Mica schist |
| | S | Serpentinite | [Stippled] | Jones fm; P ₁ Phyllite & mica schist, minor carbonates; San Lorenzo member; P _m marble |
| | | | [Cross-hatched] | Hornblende gneiss member |
| [Dotted] | | | San Agustín fm: sa, cataclastic granite gneiss sam, migmatite | |

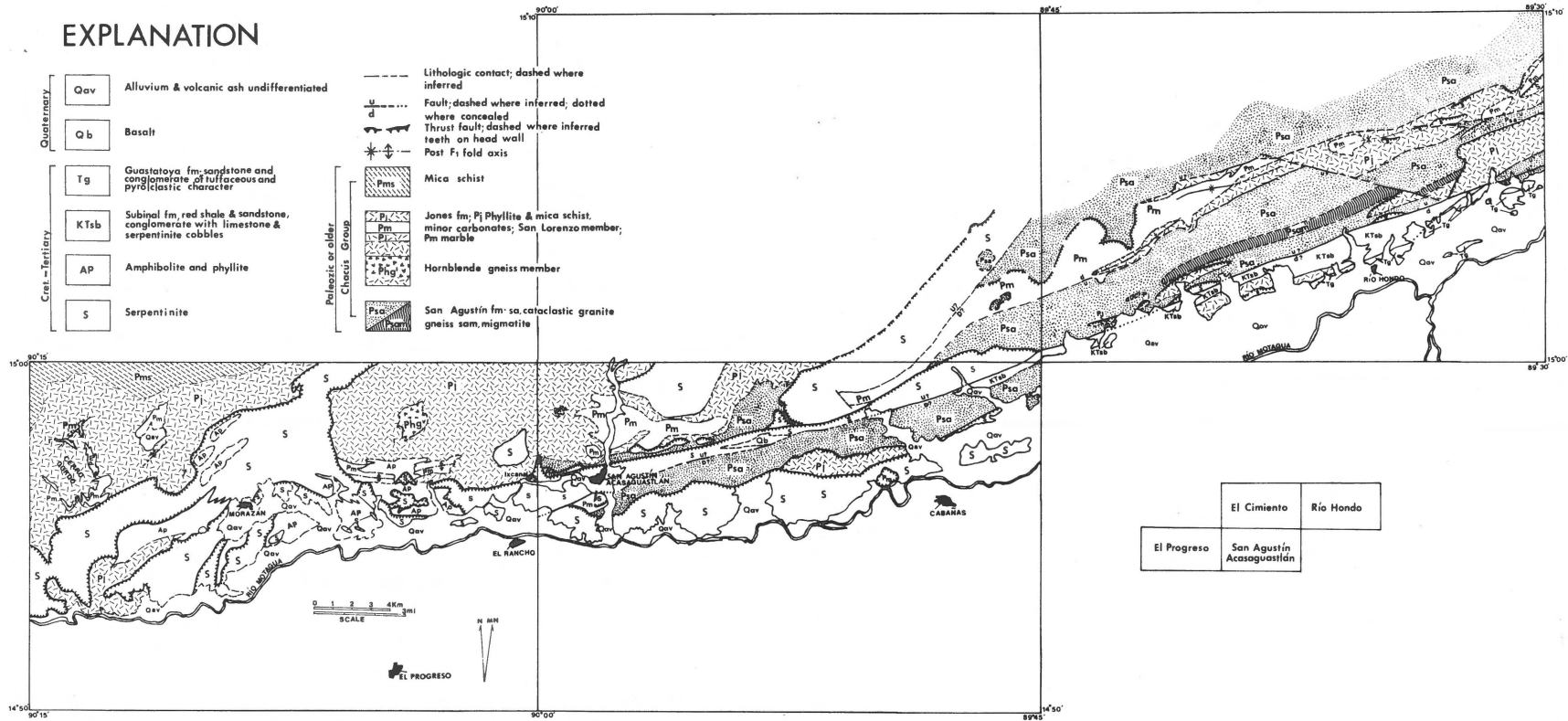


Fig. 2
 Geologic map of the four 10 × 15 minute quadrangles along the south side of the Sierra de las Minas range. The northwest quarter and northeast quarter of El Progreso quadrangle was originally mapped by McBirney (1963) and Bosc (1971) respectively. Roper remapped El Progreso quadrangle in 1971 north of the Motagua River. Bosc (1971) also mapped the San Agustín Acasaguastlán quadrangle which was remapped by Newcomb (1975). Newcomb also mapped parts of the Río Hondo and southeast corner of El Cimiento quadrangle. All four maps have been simplified in detail. The trace of the Motagua fault zone parallels the valley formed by the Motagua River.

matites, which may be an extension of the San Agustín migmatites.

In addition to the differences mentioned above a couple of distinctive rock types can be recognized in the Jones Formation. However, due to intense polydeformation and metamorphism, the exact stratigraphic relationship of these rock units within or with respect to the Jones Formation is not firmly established. At present they are included in the Jones Formation as separate units because Jones Formation lithologies are found above and below them.

Structurally, the lowest of these units is a very distinctive medium to coarse-grained hornblende gneiss with felsic dikes which has only been recognized in the northeastern part of El Progreso quadrangle (Fig. 2). The northwest side of this unit is conformable with and grades into the mica schist and gneiss of the Jones Formation. The southern boundary is obscured. It is believed that this unit is in the lower part of the metasedimentary sequence for the following reasons: (1) its flow banding, large crystal size, and higher temperature minerals such as hornblende instead of tremolite, andesitic plagioclase (An 25-33) suggest higher temperatures of crystallization and greater mobilization than lithologies higher up in the sequence; (2) it is associated with the area of highest metamorphic grade in this region.

The chemical composition of the hornblende gneiss is more mafic than the chemical range that NEWCOMB (1975) delineated for the San Agustín Formation, but is consistent with other Jones Formation lithologies. The stratigraphic and petrologic significance of hornblende gneiss is unknown. It could be a transposed portion of the basal Jones Formation by either complex sheared-out folding or faulting. However, the possibility that it could be a small intrusive pluton cannot be ruled out. A formation name is not given to this unit at this time because of these ambiguities.

The San Lorenzo Formation defined by NEWCOMB (1975) is a very pure fine-grained, black to white, massive to finely banded, fetid high calcium marble. This lithology designated Cm by ROPER (1976) is the best marker horizon in the entire Chuacús Group throughout the Sierra de las Minas range. NEWCOMB's (1975) work in the Río Hondo quadrangle shows that the San Lorenzo marble forms the core of some second generation synforms, which led him to conclude that it was stratigraphically above the Jones Formation, and because of its unique character deserved the rank of a separate formation. However, figure 2 indicates that the Jones Formation is least abundantly exposed in the Río Hondo quadrangle and becomes progressively more abundant to the southwest where topographic uplift and erosion of overlying units is less intense. Thus, it is in the eastern part of the study area where the oldest part of the section is best exposed, and the western part of the region has retained the upper metasedimentary section in greater detail.

In El Progreso quadrangle, the San Lorenzo marble occurs at the crest and inner portions of large antiforms with Jones lithologies above and below it. This is illustrated (Fig. 2) in the

western part of El Progreso quadrangle around Cerro Gordo where this unit can be easily traced for about seven kilometers on the upper limb of a large refolded nappe (ROPER, 1976) with Jones Formation lithologies above and below it. Thus, this relationship, in contrast to NEWCOMB's (1975) interpretation, suggests that the San Lorenzo marble is best regarded as a marker horizon within the Jones Formation, and not as a separate formation because the lithologies above and below the marble cannot be distinguished. An alternate possibility is that the San Lorenzo marble is a diachronous unit within the ninety (90) kilometers of the region studied.

The stratigraphic position of the San Lorenzo marble within the Jones Formation is believed to be near the top of the Formation. This interpretation is supported in the northwestern corner of El Progreso quadrangle where another distinctive unit composed primarily of muscovite schist is found overlying and at approximately the same elevation as the San Lorenzo marble which is just a few kilometers to the south.

Muscovite schist (informal unit of formation rank)

Overlying the Jones Formation in the northwestern corner of El Progreso quadrangle is another formation of the Chuacús Group which is composed predominantly of muscovite schist, and to a lesser extent of micaceous quartzite. Few or no accessory minerals are found in these rocks suggesting that they are metamorphosed argillaceous sandstone. Some of these rocks show distinct signs of cataclasis, though no major fault zone was found in the area. This unit is the highest recognized structural and stratigraphic formation within the Chuacús Group in the Sierra de las Minas range. It was designated C₁ by ROPER (1976).

CONCLUSIONS

The lower portion of the Chuacús Group outcrops in the central and eastern portion of the Sierra de las Minas range, whereas the upper portion of this complex is more complete toward the western end.

The chemical range of the Jones Formation as defined by NEWCOMB (1975) may be misleading with regard to the total iron and magnesium in the original rocks because he regarded tremolite as the primary amphibole in those rocks. Polymetamorphic textures and structural relationships suggest that tremolite resulted from superimposed metasomatism due to serpentinite emplacement during the Mesozoic and Tertiary.

The hornblende gneiss found in the northeastern portion of El Progreso quadrangle should be regarded as a separate formation within the Chuacús Group unless it can be demonstrated to be an intrusive pluton. This unit probably belongs in the lower portion of the Chuacús Group.

The San Lorenzo marble should be regarded as a member within the Jones Formation because mica schist and gneiss above it cannot be distinguished from similar rocks below it.

The uppermost Formation of the Chuacús Group recognized to date is a metasedimentary muscovite schist which has only been found in the northwestern part of El Progreso quadrangle.

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