

diano de cuantos contribuyen hoy al conocimiento cada vez más preciso de la geología de las Montañas Cantábricas.

F. H. Cramer & R. Rodríguez (*).—ROBLEDO AND ARROYACAS FORMATION (ARROYO DE LAS ARROYACAS, PROVINCE OF PALENCIA, SPAIN) PALYNOLOGICALLY DATED AS LATE SILURIAN.

AMBROSE 1974 described three more or less new Lower Paleozoic Formations at the Horca de Lores, in the very north of the Province of Palencia. These formations are: 1. The Robledo Formation (said to consist of 160 m of quartzites and sandstones with minor shales; no macrofossils present; AMBROSE nevertheless correlated the Robledo Formation with the Arenigian (*sic*) Barrios Formation in the Province of León); 2. The Arroyacas Formation (350 m of black shales and dark sandy shales. The discovery of a Ludlovian graptolite in the upper part of the formation prompted AMBROSE to correlate the Arroyacas Formation with the slightly diachronous, but essentially Upper Llandoveryian through Late Wenlockian Formigoso Formation of León); and 3. The Late Silurian to Earliest Devonian Carazo Formation.

The type sections of the Robledo and the Arroyacas Formations are in the Arroyo de las Arroyacas, 2 km northwest of the village of Lebanza (42° 58' 45" N; 04° 31' 10" W) and the type section of the Carazo is along the Río Araúz, to the northwest of the village of Vidrieros (42° 58' 46" N; 04° 38' 00" W). The palynology of the Carazo Formation in the Araúz Valley is now known: the entire Araúz sequence is Latest Ludlovian through Gedinnian in age. LOBATO presents a succinct geological map and a summary of the lithology of the Araúz Valley; CRAMER & RODRÍGUEZ date the lower part of the section with palynomorphs (*in*: LOBATO *et al.* 1977).

The abundant and quite well preserved acritarchs, miospores and chitinozoans of the Robledo and Arroyacas Formations in the valley of the Arroyo Arroyacas bracket the age of the entire Arroyacas section (that is: the oldest two of AMBROSE's formations) within the interval of Late Ludlovian to Gedinnian. The

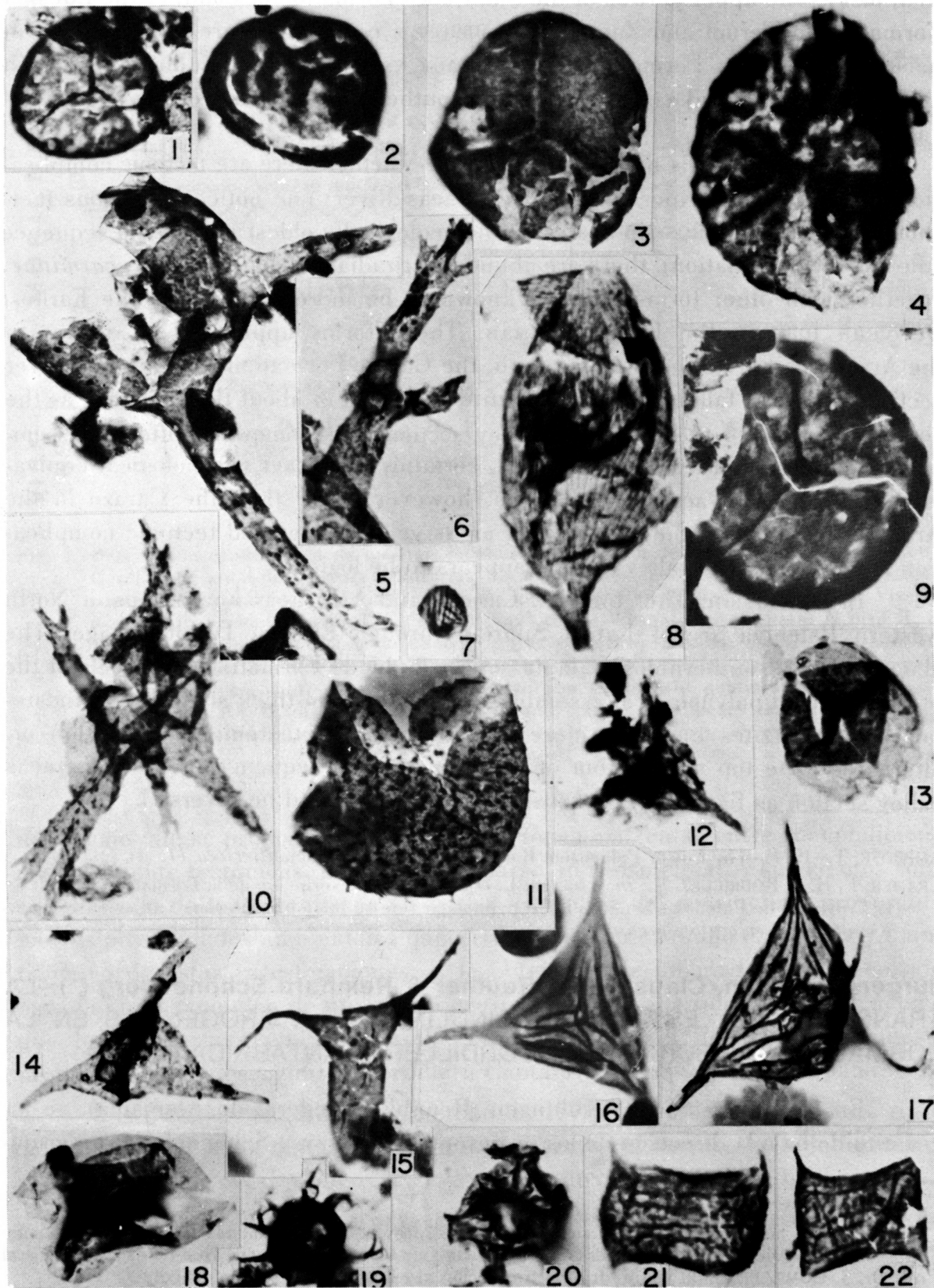
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PLATE I

1. *Synorisporites downtonensis* RICHARDSON & LISTER 1969. 2. Distal side of an as yet undescribed murinate miospore, characteristic of the San Pedro Formation of León. 3. *Retusotriletes* sp. D. *in*: RICHARDSON & IOANNIDES 1973. 4. *Emphanisporites* cf. *robustus* MCGREGOR 1961. 5, 6. *Multiplicisphaeridium denticulatum* (STOCKMANS & WILLIERE 1963) of a much larger size than the specimens described to date. 7. As yet undescribed acritarch. 9. *Leiofusa cantabrica* CRAMER 1964. 9. *Ambitisporites avitus* HOFFMEISTER 1959. 10. *Multiplicisphaeridium denticulatum* (STOCKMANS & WILLIERE 1963). 11. *Multiplicisphaeridium* cf. *gotlandicum* (EISENACK 1954). 12. *Stellinium* sp. 13. *Quadraditum fantasticum* CRAMER 1964. 14. cf. *Multiplicisphaeridium scaber* CRAMER & DIEZ 1976. 15. *Veryhachium trispinosum* (EISENACK 1938): This specimen shows a fortuitous bilateral symmetry and is not conspecific with *Domasia limaciforme*, from which it is distinguished by a different wall structure. 16, 17. *Neoveryhachium carminae* (CRAMER 1964): triangular variants, characteristic of the Silurian-Devonian transition. 18. *Quadraditum fantasticum* CRAMER 1964. 19. *Multiplicisphaeridium ramusculosum* (DEFLANDRE 1948). 20. As yet undescribed form, characteristic of the San Pedro Formation of León. 21, 22. *Neoveryhachium* sp., characteristic of the San Pedro Formation of León.

Magnification of all specimens, approximately 1.000x.

assemblages recovered from the Arroyacas section all belong to the typical unequivocal Late Silurian –Earliest Devonian suite with abundant low-sculptured and smooth miospores, acritarchs of the *Neoverhachium carminae*-suite, and with chitinozoans of the *Linochitina cingulata* and *Ancyrochitina fragilis harpago*-suite. (Selected, characteristic components of these suites and recovered



from the Arroyacas section are illustrated in Plate I). Thus, the Robledo Formation is not at all Arenigian in age as implied by AMBROSE (and is obviously not correlated with the Barrios Formation); the Arroyacas Formation at AMBROSE's fossil locality is certainly not age-equivalent with the Formigoso Formation of León (instead, the Arroyacas accumulated during the Silurian-Devonian transition, just as the upper portion of the San Pedro Formation of León, or the Luesma Formation in Teruel and Zaragoza). AMBROSE's correlations are thus quite erroneous. The Carazo Formation in the Araúz valley is latest Ludlovian through Gedinnian in age and corresponds with southernmost portion of the Arroyacas valley section.

At this time, it is difficult to determine whether there are tectonic complications in the section exposed at the Arroyacas River; one notices a curious fact, though: in what AMBROSE indicates as the geologically oldest part of the sequence (the Robledo Formation), there are abundant triradiate specimens of *N. carminae*, together with other forms that are known to be more common in the Earliest Devonian than in the Latest Silurian. These forms appear to be absent in the Arroyacas Formation. Furthermore, the Carazo Formation of the Araúz River section—although falling in the same suite and being of about the same age as the southern portion of the Arroyacas valley section—has somewhat different assemblages. Both sequences are, therefore, certainly not exact chronological equivalents. As the Arroyacas Formation is, however, older than the Carazo in the Araúz valley section, the existence of an as yet unrecognized tectonic complication in the Arroyacas valley section appears to be logical.

In conclusión: The Robledo, Carazo, and Arroyacas Formations of Northwestern Palencia are of Latest Silurian through Earliest Devonian age. The geographically southernmost samples of the Robledo Formation have yielded the most advanced palynological assemblages; the series of thick shales and sandstones and quartzites must therefore be marked by a tectonic complication or, alternately, the top and bottom of the stratigraphic sequence of the Arroyacas valley section as figured by AMBROSE (1974: fig. 2) should be reversed.

AMBROSE, T. (1974).—The Lower Palaeozoic Rocks of Northern Palencia *Breviora* 14, (4), pp. 49-53.

CRAMER, F. H. & RODRÍGUEZ, R., in: LOBATO, L. *et al.* (1977).—Descripción de la Formación Carazo de la Provincia de Palencia, España: Edad palinológica de su miembro inferior: Ludloviense medio o superior. *Breviora* (en prensa).

Jürgen Kullmann, Claus-Dieter Reuther & Reinhard Schönenberg (*).—LA TRANSICION DEL ESTADIO GEOSINCLINAL A LA OROGENESIS EN LA FORMACION VARISCICA DE LA CORDILLERA CANTABRICA (**).

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