Fritz H. Cramer-Díez (*), Manuel Julivert (**) & M.ª Carmen Díez (***).—
LLANDEILIAN CHITINOZOANS FROM RIOSECO, ASTURIAS, SPAIN. PRELIMINARY NOTE.

Although large assemblages of chitinozoans have been described from Silurian and Devonian sediments in Spain (CRAMER 1964, 1966; CASIELLES & TRUYOLS 1969), specific information on the occurrence and regional distribution of Ordovician chitinozoans is lacking. This is the first note on the specific occurrence of chitinozoans in Asturias. A large report, covering palynostratigraphy and taxonomy of several Ordovician chitinozoan assemblages from several localities in northern and south-central Spain is in preparation.

The chitinozoans discussed here are from the black, graptolite-bearing shale at the top of the Sueve Shale Formation, approximately 2.5 km due west of the village of Rioseco, Asturias. This is locality R-2 which was discribed recently by JULIVERT, MARCOS, PHILIPPOT & HENRY (1968). The reported presence of *Diplograptus (G.) teretiusculus* in these shales dates the chitinozoan-bearing layer as Llandeilian (equivalent of graptolite zone 8 of Elles & Wood). This zone would correspond with a radiometric age date of close to 460 my (data summarized by HARLAND, SMITH & WILCOCK 1964).

The organic fraction was concentrated from the black, slightly pyritiferous shales by conventional palynological processing, i.e., conversion of the shales to a slurry with 78 percent hydrofluoric acid at room temperature, followed by flotation in 2.0 aqueous zincbromide at 4,000 rpm/60 minutes. The organic fraction was left unstained. Although the float was made up for over 50 percent by volume by subspherical, simple or composited, globules of kerogenic material, no recognizable acritarchs or tasmanites-like algae were found. The globules do probably not represent altered *Gloeocapsamorpha* or similar algae. A very minor amount of graptolite fragments were present as well as some malanoskleritoid remains. About forty percent of the organic float consisted of well preserved though mostly flattened, chitinozoans.

The chitinozoans are apparently complete, and almost all of them are unbroken.

The following chitinozoans were identified:

Ancyrochitina bulmanni (JANSONIUS 1964) [R]
Conochitina chydaea JENKINS 1967 [C]
Conochitina lepida JENKINS 1967 [C]
Conochitina micracantha EISENACK 1931 [R]
Conochitina oelandica EISENACK 1955 [C]
Conochitina robusta EISENACK 1959 [R]
Cyathochitina calix (EISENACK 1931) [R]
Cyathochitina campanulaeformis (EISENACK 1931) [R]
Cyathochitina kuckersiana (EISENACK 1934) [R]
Desmochitina minor EISENACK 1931 [R]

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Desmochitina minor erinacea EISENACK 1931 [R]
Lagenochitina baltica EISENACK 1931 (elongated forms) [R]
Pterochitina 1 [C]
Rhabdochitina magna EISENACK 1931 [C]
Forms of a general morphology comprised between the extremes: *Rhabdochitina usitata* JENKINS 1967 and *Sphaerochitina compactabilis* JENKINS 1959 [D]
A form with an originally smooth, unornamented surface, of a general outline and variability similar to that of *Sphaerochitina lepta* JENKINS 1970 [D]
[R=rare (< 1 % of sum total of recognizable chitinozoans); C=common (< 10 %); D=dominant (> 10 %)].

As indicated by the megafossils, this chitinozoan assemblage characterizes the Spanish Llandeilian. Its composition agrees well with reported chitinozoan assemblages from other areas of Upper Ordovician age. Compositionally, the Rioseco assemblage occupies a position intermediate between Llandeilian chitinozoan associations from Shropshire and from the Sahara. It is interesting that no *Siphonochitina* or *Velatichitina* spp. or metamorphical derivates were found, and that *Herkochitina* and *Cyathochitina campanulaeformis* and morphologically similar taxa are very rare (up to less than 0.5 percent of the sum total of identifiable taxa).

The kerogenic globules, the chitinozoans, and the graptolite remains are all equally translucent to Xe-generated I.R. radiation and show on theWILD Image Converter tube a low to very low contrast (diaphragms of microscope condensers fully open, observed at 125 × magnification). No fractures, except for accidental ones, are visible in the specimens. In normal white light, the color of the organic material varies from a yellowish brown to a dark reddish gray-brown, whereby the thickest specimens are the least yellowish in color. Many specimens appear quite black which is apparently caused by an accumulation of very fine organic particles (about 2 microns or less) on their surface.

We believe that these transparencies indicate that the shales never have attained a paleotemperature of more than 140 degrees centigrade, and that its minimum temperature cannot have been less than 60 degrees. No systematic cracks characteristic of mosaic-shattering (BURMANN 1968) are present in the specimens. Some evidence of incipient flow of the wall substance is indicated by the crinckly, corrugated appearance of the ectoderm surface of a few specimens. This surface texture is identical to the specific differentiator used in *Conochitina tigrina* (LAUFELD 1967: pp. 311-312, fig. 16: B, C). It would appear that the shales of the Sueve Formation, at Rioseco, have never been buried deeply, nor that they have been penetrativelly deformed. The unusually low thermal alteration of the kerogenic material at Rioseco suggests, presuming a normal geothermal gradient, a past burial to a depth of more than 1500 and less than 3500 meters.

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M.ª C. Argüelles (*).—ESTUDIO PETROLOGICO DE LA FORMACION CANDANA

I. Introducción.—Se estudia una serie del Cámbrico inferior del occidente de Asturias, en la hoja n.º 51 del mapa Topográfico nacional, entre Villanueva de Sorriba (Km. 21) y el Rodical (Km. 14) donde se sitúan las calizas del Cámbrico medio.

Entre las referencias bibliográficas pueden citarse las de Ch. BARROIS (1882), LOTZE (1957 y 1961) que introdujo el nombre de areniscas de Cándana, COMTE (1959), GARCÍA DE FIGUEROLA (1962) OELE (1964) CAPDEVILA (1965, 1969), MATTE (1968), ZAMARREÑO & JULIVERT (1967). El trabajo más reciente se debe a PARGA & LUQUE (1971) con un estudio sobre el Cámbrico inferior y Eocámbrico en la Cordillera Cantabrica en el valle del río Narcea.

II. Petrología.—En la serie, corte del río Narcea, PARGA & LUQUE (1971) distinguieron los siguientes tramos: Miembros de la Fenosa, Sorriba, Pilotuerto, La Florida, Valserondo, y Dolomías de Vegadeo, que también hemos localizado en esta serie excepto el miembro de La Fenosa en el límite con el Precámbrico. La composición petrográfica es muy variable, comprende desde microconglomerados, litarenitas, pizarras y arcosas hasta ortocuarcitas, así como capas carbonatadas.

El miembro de Sorriba presenta una secuencia de litarenitas a ortocuarcitas con microconglomerado en la base. El resto de la serie presenta varias secuencias de arcosas a ortocuarcitas. Las capas pizarrosas se encuentran intercaladas a lo largo de toda la formación de modo irregular.

Los tipos de rocas que aparecen son:

a) Microconglomerados.—Granos subredondeados y angulosos de tamaño muy grueso con matriz arcillosa-silícea abundante que contiene cloritas y óxidos de hierro. Granos de cuarzo, chert, cuarcitas, rocas efusivas, pórfidos cuarcíferos y minerales pesados. Se caracterizan por la abundancia de cuarzos de origen volcánico y de rocas efusivas, matriz recristalizada y óxidos de hierro may frecuentes, lo que les da color rojizo.

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