ANEXO A. INVENTARIO BIBLIOGRÁFICO
REFERENCIAS BIBLIOGRÁFICAS PLANCHA 349 CAFRE - CHARCÓN

TITULO	AUTOR	REFERENCIA	RESUMEN
Caguán and Putumayo Basins. Petroleum Geology of Colombia	AGENCIA NACIONAL DE HIDROCARBUROS	2011. ANH Volume 4, p. 125 UNIVERSITY EAFIT Department of Geology Chairman Geovany Bedoya San miguel, MSc.Project Manager Montenegro y Barragan	Elements which define a sedimentary basin are related to tectonic characteristics acting during its origin, sediment type and source, and the environment in which sedimentation occurred. In this sense, it is important to stress that geological characteristics identified in the Caguan and Putumayo areas are different enough that they deserve to be considered as two different basins. The Putumayo basin is a portion of a large geologic province formed by the Marañon Basin in Peru, Oriente Basin in Ecuador and Putumayo Basin in Colombia (Higley, 2001), the latter being the northernmost of the province.The Putumayo basin has a triangular shape and its limits are formed by the Oriental Cordillera on the east, the Garzon massif on the northwest,the Florencia arc on the east. On the south lies the Oriente basin, withoutany identified geological limit between both.The Caguan Basin lies immediately north of the Putumayo basin andits limits are defined by the Garzon Massif on the north, the Macarena sierraon the north and north-east, the Florencia high on the south. Eastward its extention may be limited by a high, identified in the magnetometricmap as the Yari alto (ICP, 1998) or byits sediments pinching against the Guayana shield crystalline rocks.

Constraining basement uplift in the northern Andes using detrital zircon provenance analysis: u-pb geochronological record of exhumation of the Garzón Massif, Colombia,	ANDERSON, V.	2013. 125th Anniversary Annual Meeting & Expo. Advances in Quantitative Sediment Provenance Research: Novel Approaches from Multi-Proxy Provenance Data to Provenance Modeling II, Volume 45: Denver, Colorado,The Geological Society of America, p. 889.	The Garzón massif is a major topographic barrier (2500 m), forms an extreme large climatic rain shadow, and represents the largest exposure of Precambrian basement in the northern Andes. However, its history of uplift-induced exhumation and relationship to the structural evolution of the broader Eastern Cordillera remain unclear. The Eastern Cordillera has undergone major east-west shortening since the Oligocene, with significant fold-thrust deformation and topographic development occurring during the late Miocene. On the basis of extensive, coarse-grained deposits of late Miocene-Pliocene age, previous studies have inferred uplift of the Garzón massif during the late Miocene, coincident with the rapid rise in topography elsewhere in the Eastern Cordillera. We present new detrital zircon provenance data (10 sandstone samples from middle to upper Miocene clastic fill) that indicates exhumation began at approximately 11 Ma, much later than the Oligocene initiation of shortening observed elsewhere in the Eastern Cordillera, but prior to the main phase of Eastern Cordillera uplift. The Garzón massif currently separates the elevated Upper Magdalena Valley hinterland basin from the lowland Llanos/Putumayo foreland basin, and may be associated with regional basement uplift of foreland arches (such as the Vaupés swell) that separate the Amazon and Orinoco drainage networks. As a result, improved constraints on the timing of uplift-induced exhumation of the Garzón massif will provide critical the broader Eastern Cordillera.

Geología de la plancha 350-San José del Guaviare. Mapa geológico e Informe Final.	ARANGO, M., NIVIA A., ZAPATA G., GIRALDO M., BERMÚDEZ J., ALBARRACIN H.	2011.. INGEOMINAS. Medellin	La plancha 350 San José del Guaviare se localiza en la parte centro-sur del Departamento del Meta y centro-norte del Departamento de Guaviare, en una zona de transición entre la Orinoquía y Amazonía colombiana, cubriendo una superficie de 2.000Km2. Geográficamente es atravesada por el río Ariari de norte a sur hasta llegar a la confluencia de los ríos Guayabero y Guaviare de occidente a oriente. En el área afloran rocas ígneas y sedimentarias con edades que comprenden desde el Cámbrico tardío hasta Mioceno medio a tardío y depósitos recientes. La Sienita Nefelínica de San José del Guaviare es la unidad litológica más antigua, afloran dos cuerpos, el principal se manifiesta al sur de la plancha en un área aproximada de 10 Km2 a unos a 20Km del Municipio de San José del Guaviare y otro cuerpo más pequeño de 2 Km2 en la vereda las Delicias. Esta formación se caracteriza por ser una roca holocristalina predominantemente inequigranular, con tamaños de grano que varían de fino hasta pegmatítica; es leucocrática con colores blanco, gris hasta rosado. La mineralogía predominante es feldespato alcalino, nefelina, biotita, arfvedsonita, cancrinita, como minerales accesorios presenta fluorita, granate tipo melanita, circón y epidota. Se presenta un carácter mixto entre las texturas de los dos aforamientos, el cuerpo principal muestra una textura hipidiomórfica granular y localmente muestra zonas con orientación mineral y bandeamiento predominando la textura granoblástica. El cuerpo de Las Delicias, presenta orientación marcada

			macroscópicamente por minerales máficos esencialmente de anfíboles, conservando estructuras migmatíticas homófonas y nebulíticas heredadas; por lo que el origen de la sienita nefelínica se relaciona con procesos anatécticos de ultrametamorfismo. El análisis de óxidos mayores y elementos traza de la sienita nefelínica muestra que las rocas presentan un exceso de álcalis con altos valores de Na2O y de K2O, con tendencia hacia el campo peralcalino, localizándose en la serie Shoshonítica; muestran un enriquecimiento de las tierras raras ligeras Y, Nb, y Rb, y decaen hacia las tierras raras pesadas, comportamiento semejante a los granitos de intraplaca tipo A.
El Paleozoico inferior de Colombia: una revaluación en base en nuevos datos de campo	BRIDGER. C.	1982. Trabajo de Grado. Universidad Nacional de Colombia.	En un amplio análisis del Paleozoico Inferior de Colombia, se revisan detalladamente las rocas paleozoicas de la zona centro, río Ariari y el extremo oriental del país (ríos Orinoco y Atabapo entre otros). En su análisis propone una unidad media del Cambro – Ordovícico, con gran extensión geográfica, que corresponde a cerros de tabloides arenoso cuarzosos en la Serranía del Chiribiquete (Caquetá Oriental) datados como arenigienses por su posición estratigráfica en relación a las otras unidades ordovícicas, a esta unidad sugiere denominarla como Formación Cananarí (en el río Cananarí, Comisaria del Vaupés, desembocadura del río Apaporis) y no como Formación Araracuara.
Propuesta de estandarización de la cartografía geomorfológica en	CARVAJAL, H.	2011. INGEOMINAS. Bogotá, 71 p.	Este documento es producto de la experiencia y de la concertación de las ideas sobre esta temática esbozadas en las "Primeras aproximaciones de la estandarización de la

Colombia			geomorfología en Colombia". Dada la aceptación de los documentos previos, por parte de la comunidad técnico científica, se ha tomado la decisión de publicarlo, para incentivar las discusiones tendientes a aplicar unos mismos parámetros y criterios en la investigación y la elaboración de la cartografía geomorfológica en el País. El documento .debe considerarse como punto de partida de las discusiones sobre esta temática en el país. En él se consignan los conceptos más importantes de la geomorfología, tendientes a definir la metodología más apropiada para Colombia. En ese sentido y con el fin primordial de organizar el pensamiento técnico científico hacia el análisis de las geoformas, se propone una jerarquización de las mismas de lo regional a lo particular en: Geomorfoestructuras, Provincias, Regiones, Unidades, Subunidades y Componentes geomorfológicos. Del mismo modo se plantea para el proceso de cartografía geomorfológica, la adaptación de la metodología desarrollada por el ITC con algunas modificaciones, producto de las experiencias obtenidas por Ingeominas con trabajos adelantados en el país.
Basin Development and Tectonic History of the Llanos Basin, Eastern Cordillera and Middle Magdalena Valley, Colombia	COOPER, M.A., ADDISON, F. T., ALVAREZ, R., CORAL, M., 3 GRAHAM, R. H., HAYWARD, A. B., HOWE, S., MARTINEZ, J., NAAR, J., PEÑAS, R.,	1995. AAPG Bulletin. Vol. 79, No 10. Pp. 1421 – 1443	Fission-track data and modeling results indicate a close correspondence in the timing and style of deformation along the western and eastern flanks of the Eastern Cordillera. East-directed fold-thrust deformation along the eastern boundary with the Llanos foreland basin was underway by the late Oligocene and early Miocene. Similarly, west-directed fold-thrust structures along the western boundary with the intermontane middle Magdalena

	PULHAM, A. J., TABORDA, A.		Valley Basin became active at approximately the same time. Less well known is the time of initial shortening within the axial segment of the Eastern Cordillera; although fission-track results suggest active exhumation by the early Miocene, shortening may have commenced much earlier during the late Eocene.
Significado geológico y asociaciones palinológicas de las formaciones Diablo inferior (Mioceno tardío) y San Fernando superior (Mioceno Medio), piedemonte cuenca de los Llanos Orientales, Colombia	DUEÑAS, H., VAN DER HAMMEN,	2007. Revista de la Academia Colombiana de Ciencias Exactas, Fisicas y Naturales, v. 31, p. 481-498	The Diablo Inferior and San Fernando Superior Formations outcrop in the Llanos Orientales Foothills, Yopal area. Recent palynological studies allow determining that the sediments from the Diablo Inferior Formation were deposited in high energy fluvial environments during the Late Miocene. Recovered palynological assemblages from these strata are also characterized by the common presence ofreworked Early Miocene, Oligocene-Late Eocene, Paleocene and Cretaceous palynomorphs. These sediments are the result of a very strong erosion period in the Eastern Cordillera during the initialphase of the Andean Orogeny.Sediments from the San Fernando Superior were deposited in shallow marine environments during the Middle Miocene. The Middle Miocene seas occupied most of the Maracaibo, Barinas-Apure and Llanos Orientales basins and transgressed toward the south until influencing the western part of the Amazon Basin.Based on the new available palynological data it is possible to correlate the Diablo Inferior and the San Fernando Superior Formations with the Lower Guayabo and Leon Formations respectively.These two last, are operational Units used by the Oil Industry for the subsurface of the Llanos Orientales Basin. The San Fernando

			Superior Formation can be also correlated with the Pebas Formation which outcrops in the western part of the Amazonas Basin.
Cuenca de los Llanos Orientales	ECOPETROL-BEICIP	1995. Estudio Geológico Regional. Informe Interno. Volumen 1.	The present report is the result of work performed jointly by staff from the state oil company ECOPETROL and BEICIP-FRANLAB, over the period 27 January 1995 to 13 July 1995, using modem basin analysis methodology. At present around 600 wells have been drilled in the basin and approximately 66 O00 km of seismic lines have been recorded. This study is based on the information fiom 200 exploration wells and about 20O00 km of seismics which have been reviewed and/or interpreted. All available stratigraphic, structural, geochemical and petrophysical data have been anaiysed, synthetized and integrated into a geological model with special emphasis on hydrocarbon genesis and accumulation. Work has been carried out at three different levels of investigation: basin analysis, petroleum system study and play evaluation.
Linking sedimentation in the northern Andes to basement configuration, Mesozoic extension, and Cenozoic shortening: Evidence from detrital zircon U-Pb ages, Eastern	HORTON B., SAYLOR J., NIE J., MORA A., PARRA M., REYES-HARKER A., STOCKLI D.	2010. GSA Bulletin., v. 122, No. 9-10., p. 1423-1442.	Laser ablation–inductively coupled plasma–mass spectrometry (LA-ICP-MS) analyses of 29 samples from the Eastern Cordillera of Colombia reveal the origin of northern Andean basement and patterns of sedimentation during Paleozoic subsidence, Jurassic–Early Cretaceous extension, Late Cretaceous postrift subsidence, and Cenozoic shortening and foreland-basin evolution. U-Pb geochronological results indicate that presumed Precambrian basement is mainly a product of early Paleozoic magmatism (520–420 Ma) potentially linked to subduction and possible collision.

Cordillera, Colombia			Inherited zircons provide evidence for Mesoproterozoic tectonomagmatic events at 1200–1000 Ma during Grenville-age orogenesis. Detrital zircon U-Pb ages for Paleozoic strata show derivation from Andean basement, syn depositional magmatic sources (420–380 Ma), and distal sources of chiefl y Mesoproterozoic basement (1650–900 Ma) in the Amazonian craton (Guyana shield) to the east or in possible continental terranes along the western margin of South America. Sedimentation during Jurassic–Early Cretaceous rifting is expressed in detrital zircon age spectra as Andean basement sources, recycled Paleozoic contributions, and igneous sources of Carboniferous–Permian (310–250 Ma) and Late Triassic–Early Jurassic (220–180 Ma) origin. Detrital zircon provenance during continued Cretaceous extension and postrift thermal subsidence recorded the elimination of Andean basement sources and increased influence of craton-derived drainage systems providing mainly Paleoproterozoic and Mesoproterozoic (2050–950 Ma) grains. By Eocene time, zircons from the Guyana shield (1850–1350 Ma) dominated the detrital signal in the easternmost Eastern Cordillera. In contrast, coeval Eocene deposits in the axial Eastern Cordillera contain Late Cretaceous–Paleocene (90–55 Ma), Jurassic (190–150 Ma), and limited Permian–Triassic (280–220 Ma) zircons recording initial uplift and exhumation of principally Mesozoic magmatic-arc rocks to the west in the Central Cordillera. Oligocene–Miocene sandstones of the proximal Llanos foreland basin document uplift-induced

			exhumation of the Eastern Cordillera fold-thrust belt and recycling of the Paleogene cover succession rich in both arc-derived detritus (dominantly 180–40 Ma) and shield-derived sediments (mostly 1850–950 Ma). Late Miocene–Pliocene erosion into the underlying Cretaceous section is evidenced by elimination of Mesozoic–Cenozoic zircons and increased proportions of 1650–900 Ma zircons emblematic of Cretaceous strata.
The Putumayo Orogen of Amazonia and its implications for Rodinia reconstructions: New U–Pbgeochronological insights into the Proterozoic tectonic evolution of northwestern South America	IBAÑEZ M., RUIZ J., VALENCIA V., CARDONA A., GEHRELS G., MORA A.,	2011. Precambrian Research., V. 191, Issues 1–2, p. 58–77.	Outcrops of late Meso- to early Neoproterozoic crust in northwestern South America are restricted to isolated exposures of basement inliers within the northern Andes of Colombia, Peru and Venezuela. However, evidence for the existence of an autochthonous Stenian–Tonian belt in northern Amazonia that is undisturbed by Andean orogenesis has not been recognized so far. Here we report ~1200 new single-zircon U–Pbgeo chronological analyses from 19 Proterozoic rock samples of northwestern South America collected from the Garzón and Las Minas Andean cordilleran inliers, drill-core samples from the foreland basin basement, and outcrops of cratonic Amazonia in eastern Colombia (western Guyana shield). Our new geochronological results document the existence of a previously unrecognized Meso- to Neoproterozoicorogenic belt buried under the north Andean foreland basins, herein termed the Putumayo Orogen, which has implications for Proterozoic tectonic reconstructions of Amazonia during the assembly of the supercontinent Rodinia. Based on the interpretations of new and pre-existing data, we

			propose a three-stage tectonometamorphic evolution for this orogenic segment characterized by: (1) development of a pericratonic fringing-arc system outboard of Amazonia's leading margin during Mesoproterozoic time from ~1.3 to 1.1 Ga, where the protoliths for metaigneous and metavolcanosedimentary units of the Colombian and Mexican inliers would have originated in a commonly evolving Colombian–Oaxaquian fringing-arc system; (2) amphibolite-grade metamorphism and migmatization between ca. 1.05 and 1.01 Ga by inferred amalgamation of these parautochtonous arc terranes onto the continental margin, and (3) granulite-grade metamorphism at ~0.99 Ga during continent–continent collision related to Rodinia final assembly. Along with additional paleogeographic constraints, this new geochronological framework suggests that the final metamorphic phase of the Putumayo Orogen was likely the result of collisional interactions with the Sveconorwegian province of Baltica, in contrast to previously proposed models that place this margin of Amazonia as the conjugate of the Grenville province of Laurentia).
Assembly, configuration, and break-up history of Rodinia: A synthesis	LI, Z., BOGDANOVA S., COLLINS A., DAVIDSON A., DE WAELE R., ERNST I., FITZSIMONS R., FUCK D., GLADKOCHUB J., JACOBS K., KARLSTROM S., LUL	2008. Precambrian Research., v. 160., p. 179–210.	Rodinia assembled through worldwide orogenic events between 1300 Ma and 900 Ma, with all, or virtually all, continental blocks known to exist at that time likely being involved. In our preferred Rodinia model, the assembly process features the accretion or collision of continental blocks around the margin of Laurentia. Like the supercontinent Pangaea, Rodinia lasted about 150 million years after complete assembly. Mantle avalanches,

	L., NATAPOV V., PEASE S., PISAREVSKY K., THRANE V., VERNIKOVSKY.		caused by the sinking of stagnated slabs accumulated at the mantle transition zone surrounding the supercontinent, plus thermal insulation by the supercontinent, led to the formation of a mantle superswell (or superplume) beneath Rodinia 40–60 million years after the completion of its assembly. As a result, widespread continental rifting occurred between ca. 825 Ma and 740 Ma, with episodic plume events at ca. 825 Ma, ca. 780 Ma and ca. 750 Ma
Contribución al conocimiento de la Paleontología Estratigráfica de la Amazonia Colombina (Incluye La Macarena): Formaciones Guayabero, San Fernando y Pebas	NAVARRETE, R.	1995. Proyecto ORAM Ingeominas. Bogotá	Se diferencian tres poblaciones faunísticas en las formaciones Guayabero, San Fernando y Pebas de La Macarena y del Valle Superior del Amazonas: Foraminíferos, Ostrácodos y Moluscos. La Formación Guayabero depositada por un paleosistema fluvial sobre una plataforma inestable, contiene dos faunulas correlativas entre sí. Faunula de *Rzehakina epigona* y Faunula de Protobuntonia spp. Del Paleoceno, las cuales se asignan al Daniense-Selandeniense temprano. La Formación San Fernando depositada en ambiento deltàico presenta tres faunulas correlativas, foraminíferos arenáceos robustos y faunula de sigmollopsis spp. La Formación Pebas registra un paleosistema fluviolacustre con episódicas incursiones marinas durante el Langiense-Serravaliense con Faunula de *Ammobaculites*.
Geological provinces of the Amazonían Craton	TASSINARI C.C.G., MACAMBIRA M. J. B.	1999.. Episodes, v. 22 p. 173-182	The Amazonian Craton (AC), located in the north of South America, is surrounded by Neoproterozoic orogenic belts and is divided into six major geochronological provinces: Central Amazonian — CAP (> 2.3 Ga); Maroni-Itacaiúnas — MIP (2.2–1.95 Ga); Ventuari-Tapajós — VTP (1.95–1.80Ga); Rio Negro-Juruena — RNJP (1.8–

			1.55 Ga); Rondonian-San Ignácio — RSIP (1.55–1.3 Ga), and Sunsás — SP (1.3–1.0 Ga). Sr, Pb and Nd isotopic compositions of igneous and orthogneissic rocks from the AC show that a significant addition of new crustal material from the upper mantle occurs during the Paleo- and Mesoproterozoic. The geochronological pattern indicated that the Archean protocraton of AC consisted formerly of independent microcontinents that were amalgamated by Paleoproteorozic orogenic belts, between 2.2 and 1.95 Ga. Part of the MIP and RSIP, and the whole of VTP and RNJP evolved by addition of juvenile magmas to the crust from 1.95 to 1.4 Ga, while the crustal evolution of SP and part of MIP and RSIP were associated with reworking of the older continental crust. No exposure of the Archean crust is known in RSIP and SP, and the Sm-Nd model ages of granitoids from those provinces indicate that the reworked crust was mostly derived from partial melting of Paleoproterozoic and Mesoproterozoic material, suggesting little or no involvement of the Archean crust in the southwestern portion of the AC.

Mapa geológico de la Plancha 211-Tauramena.	ULLOA, C., RODRÍGUEZ, C.	1976. Publicada en 1983. INGEOMINAS, Bogotá.	El área objeto de este informe está localizada en el borde oriental de la Cordillera Oriental de Colombia y se caracteriza por una topografía abrupta a suavemente ondulada en la región andina y plana en los Llanos Orientales. Se describen las rocas sedimentarias de las cuencas de los Farallones y Borde Llanero, lo mismo que pequeños diques y apófisis de lamprófiros que intruyen rocas de la Formación Lutitas de Macanal. También se describe las tres áreas tectónicas que presenta la Cordillera Oriental en el área de este trabajo, sus eventos geológicos e históricos y sus principales recursos minerales.
Estratigrafía del Terciario y del Maastrichtiano y tectogenesis de los Andes Colombianos	VAN DER HAMMEN, T.	1960. Inf. 1279. Ingeominas. Bogotá	El presente artículo da los resultados de las investigaciones estratigráficas-palinológicas llevadas a cabo en los últimos años por la Sección de Paleobotánica del Servicio Geológico Nacional. Después de discutir los métodos de correlación palinológica y los problemas de la determinación de edad, se describen las formaciones de cada región importante dentro de cada Unidad Geológica. De cada formación se da el nombre del autor que la describió por primera vez, su localidad típica y una corta descripción de su litología; se discute también la edad, y las correlaciones más importantes con otras formaciones.
Uplift age of the Garzón Massif (Eastern Cordillera, S. Colombia) in relation to the infill of the adjacent S.	VAN DER WIEL, A.M	1990. Symposium International Géodynamique Andine. Abstracts: Grenoble, France, p. 217-218.	The present investigation was carried out in order to determine the age of the uplift of the Garx6n Massif, the most southern extension of the Eastern Cordillera of the Colombian Andes, and its effects on the sedimentation within the adjacent S.Neiva basin. To that purpose fission track age determinations were done on apatite from samples

Neiva Basin			taken at different elevations within the massif and the ~tratigraphic and sedimentary relations of the deposits filling the adjacent SHeiva Basin were studied, while K-k detaminations on these deposits provided the necessary time control. The S.Neiva Basin constitutes a broad tectonic depression situated between the Central and Eastern Cordilleras in the south of Colombia. It is filled with some 3500 m of fluvial material deposited during uplift of the Central Cordillera and f900 m of volcaniclastic and volcanic sediments derived from the Central Cordillera volcanic arc. The fluvial sediments belong to the Gualanday and Honda formations; the vokaniclastic and volcanic deposits are grouped into the Cligante Formation. This latter formation is subdivided into three members: a lower and upper conglomeratic member and a middle volcaniclastic member. K-Ar determinations were carried out on biotite and hornblende separates from samples taken at stratigraphically controlled positions. The middle volcaniclastic member of the Gigante Formation was dated at 8.3-7.0 Ma and an age of 6.66.2 Ma was obtained for the upper conglomeratic member. The lower part of the Honda Formation was dated at 16.1-14.6 Ma. The age of the lower conglomeratic member of the Gigante Formation was estimated at 11-8.3 Ma. From the effective track retention temperature of apatite and the present elevation of the highest samples it is calculated that the Garz6n Massif was uplifted approximately 6.5 km. Apparent fission-track ages of apatites date the uplift at some 12 Ma ago. This implies that the Gigante Formation was deposited after the uplift

			S.S. Paleocurrent directions from the Honda Formation and lower two members of the Gigante Formation are to the east., indicating that the uplifted massif at first had little influence on the drainage pattern of the basin. Only 5 million years after the uplift, during deposition of the upper conglomeratic member, the drainage system in the basin changed direction and &watering was to the North. In the northeastern part of the studied area, the Gigante Formation shows interfingering with conglomerates with a provenance east of the present basin while to the NW only the upper conglomeratic member interfurgers with these conglomerates. Apparently, erosion products from the uplifted massif spread further west in time, reflecting the increasing activity of erosion and denudation Evzi compared to the vast amounts of fluvial sediments produced during uplift of the Central Cordillera, the thickness of the deposits resulting from uplift of the Garx6n Massif is minimal. This fact and the fact that the uplift took place some 12 Ma ago, but that the rivercourses were influenced only 7 million years ago, lead to the conclusion that the uplift of the massif hardly influenced sedimentation processes in the adjacent basin. There are two possible mechanisms which may have prevented deposition of the major part of the erosion products into the SHeiva Basin: 1. An alignment of intramontane basins can be found within the Garx6n Massif parallel to its western border along one of the major faults. Gec&ctrical and sedimentological investigations indicate that one of these basins, the Pitalito Basin, is at least 1200 m

			deep and is probably filled with Pliocene to 218 Pleistocene fluvial deposits. However, the electcicpl conductivity studies do not exclude a much deeper basin that than could be filed, at least the deeper part of it, with erosional products derived from Jurassic intrusives borderhg the basin. Therefore, it is conceivable that the inrramontane basins were formed during the uplift and acted as a sediment hap, preventing the erosion products from entering the S.Neivo Basin. 2. In the Putumayo Basin dhctly to the ePft of the Gti Massif, some 700-800 m of Upper Tertiary fluvial sediments are found. Possibly the msssif was tilted to the east during uplift and the sediments were deposited preferentially in the Putumayo Basin.
Lake Pebas: a palaeoecological reconstruction of a Miocene, long-lived lake complex in western Amazonia	WESSELINGH, F. P., RÄSÄNEN, M. E., IRÍON, G., VONHOF, H. B., KAANDORP, R., RENEMA, W. , ROMERO, L. P., GINGRAS, M.	2002. Cainozoic Research, v. 1, no. 1-2, p. 35-81.	The taxonomic composition and palaeoecological signature of molluscan faunas from the Miocene Pebas Formation of Peruvian Amazonia are assessed. The Pebas fauna is almost entirely made up of extinct, obligate aquatic taxa, and is dominated in numbers of species and specimens by endemic cochliopine hydrobiid gastropods and pachydontine corbulid bivalves. Molluscan assemblages are defined and linked to depositional environments. Isotope data from the shells indicate freshwater settings during deposition of the Pebas Formation, with the exception of a few incursion levels that were deposited under oligohaline-mesohaline conditions. Faunal and isotope geochemical data point to a large, long-lived freshwater lake system at sea

			level with swamps and deltas, open to marine settings in the north (Llanos Basin). Sedimentological data and ichnofossils point to (restricted) marine settings. These different interpretations are discussed, and it is concluded that faunas (including ichnofabrics) from evolutionary isolated and longlived systems cannot be assessed in a straightforward actualistic mode, using taxa from non-long-lived environments for comparison. Aspects of Lake Pebas are compared with modern depositional environments. Lake Pebas is among the largest and longestlived lake complexes in Phanerozoic history; it was an important stage for the evolution of endemic molluscan and ostracod faunas. It may have played some role in the transition of marine biota to Amazonian freshwater environments during the Miocene, and likely was an important, hitherto unrecognised, dispersal barrier for terrestrial organisms in northwest South America during the Miocene.