RESUMEN

Un análisis de facies detallado se llevó a cabo en los depósitos fluviales del Grupo Chubut y marinos de la Fm La Colonia que se exponen en el Noreste de la Provincia de Chubut. La Formación Marifil representa las rocas ígneas más antiguas en el área, constituye el basamento sedimentario y perfiles geoeléctricos del subsuelo, determinaron un desarrollo irregular del mismo. Un conjunto de elementos arquitecturales caracterizan al sistema fluvial del Grupo Chubut: lacustre expuesto sólo al norte, y elementos de canal, faja de canales y de llanura de inundación al sur. Estos últimos, presentan una progresiva variación desde abanicos aluviales en la base, sistemas entrelazados y sistemas de canales arenosos en cinta, depositados en sucesivos episodios con depósitos de desborde. En el tramo superior de la sucesión se reconocieron cinturones meandrosos poco desarrollados y canales aislados, culminando con un importante desarrollo de elementos de llanura de inundación. Asociado a los depósitos de llanura de inundación, se reconocieron rasgos post-depositacionales vinculados con procesos de licuefacción/fluidización, relacionados con una etapa de telodiagénesis. Una sucesión vertical de 4,5 m, comprende cuatro intervalos bien definidos: fragmentado in situ, brechado, brechado fango sostenido y superior homogéneo, con potenciales conductos de escape, Constituyen un ejemplo excepcional de desarrollo natural de brechamiento en un medio frágil y los mecanismos disparadores podrían estar asociados a actividad sísmica o a impacto de bólidos. A partir del análisis de circones detríticos, se determinó para el Grupo Chubut una edad máxima de depositación albiana, *ca.* 106 Ma en la localidad de Telsen y *ca.* 109 Ma en el sector Cañadón Williams. Las

fuentes de procedencia para el Grupo corresponden principalmente a la Formación Marifil, cuya edad quedó acotada para el área entre 182 y 188 Ma. La comparación de los datos jurásicos en las dos muestras analizadas, sugiere una modificación progresiva desde el NE al E-SE del sector de aporte al Grupo Chubut. En contacto neto – erosivo sobre el Grupo Chubut, se dispone asociado a la Fm La Colonia, un conglomerado tabular basal, que representa una superficie de ravinamiento, de importancia significativa en la estratigrafía secuencial. Fue interpretada como una superficie transgresiva que evidencia para el área de Telsen el comienzo de la ingresión maastrichtiana. Le suceden hacia arriba, asociaciones de facies de *frente de playa a "off shore*", *intermareal* (llanura mixta y llanura fangosa), lagunas con influencia marina y lagunas sin aparente conexión marina en el sector supramareal, con esporádicas intercalaciones arenosas con estructura de domo y cuenco en la base. Se indicaron para la Fm La Colonia ambientes restringidos de baja energía, asociados a una costa fangosa, afectada por episodios de tormenta. Considerando el hiato que media entre el Grupo Chubut (Albiano) y Fm La Colonia (Maastrichtiano/Daniano), se propone considerar como Formación La Colonia, al conjunto de pelitas verdosas a grisáceas, de origen marino, ubicadas por encima de la superficie transgresiva, mientras que las pelitas continentales por debajo de esta superficie, hasta el momento pertenecientes a la Fm La Colonia, quedarían incluidas en el Grupo Chubut. Una discontinuidad de bajo ángulo, con una inclinación de aproximadamente 0.5%, que trunca al Grupo Chubut y a la Formación La Colonia fue reconocida en el área. Un mapeo de semidetalle de las unidades geológicas y un mapeo de detalle de los paleoambientes, complementan la información cartográfica preexistente.

ABSTRACT

A detailed facies analysis was performed on the fluvial deposits of the Chubut Group as well as on the marine deposits of La Colonia Formation, both located at Northeast-Chubut Province. The Marifil Formation represents the older igneous rocks in the area, constitutes the sedimentary basement and geolectric profiles determined an irregular morphology for the subsurface deposits of the unit. The fluvial system of the Chubut Group is characterized by a number of architectural elements: lacunar in the North, and channel, channel belt and floodplain elements in the South. The last elements, as exposed in a vertical succession, vary progressively from alluvial fans in the bottom, braided systems and multistorey sandstone- dominated ribbon channels with crevasse splay deposits. The upper part of the succession evidences poorly developed meander belts and isolated channels, ending with a significant development of the floodplain elements. Post-depositional features recognized in the floodplain deposits evidence liquefaction/fluidization processes and they were associated with a telodiagenetic stage. The 4,5m vertical succession comprises four well-defined intervals: fractured, brecciation, mud-rich breccias and upper fully shared, including potential escape conduits. They represent an exceptional example of naturally developed brecciation in a brittle medium. These processes may have been originated by seismic activity or bolides impact. The analysis of detrital zircon yielded the Aptian as the maximum depositional age for the Chubut Group, ca. 106 Ma in Telsen, and ca. 109 Ma in the Cañadón Williams area. The sources for the Chubut Group correspond mainly to the Marifil Formation, whose age in the area was restricted between 182 and 188 Ma.

Comparing the Jurassic data in the two samples analyzed, suggests a progressive modification of the Chubut Group source area from the NE to E-SE. Associated to the La Colonia Formation deposits, a basal tabular conglomerate, lying in sharp erosive contact with the Chubut Group, represents a ravinement surface and constitutes a key surface from a sequence stratigraphy approach. It was interpreted as a transgressive surface and evidences the beginning of the Maastrichtian ingression for the area. Upwardly, this surface is succeeded by facies associations related to shoreface to offshore, intertidal (mixed and mud flat), lagoons under marine influence and lagoons with no apparent marine relation in the supratidal zone. Low-energy restricted environments, associated with a muddy coast affected by storm episodes, were interpreted for the La Colonia Formation. Taking into account the hiatus between the Chubut Group (Albian) and the La Colonia Formation (Maastrichtian/Danian), is herein proposed, that the latter ought to be associated with the set of marine greenish-gray mudstones on top of the transgressive surface, while the continental mudstones under this surface -related up to now to La Colonia Formation- should be included in the Chubut Group. A low-angle discontinuity that cut across the Chubut Group and La Colonia Formation, of about 0.5%, was recognized in the area. A semi-detailed mapping of the geological units and a detailed-mapping of the palaeoenvironments, complement the cartographic information available.

XI BIBLIOGRAFIA

Acevedo, R., Ponce, J., Rocca, M., Rabassa, J. y Corbella, H. 2009. Bajada del Diablo impact crater-strewn field: The largest crater field in the Southern Hemisphere. *Geomorphology, v.* 110: 58 - 67.

Allen, J. 1977. The possible mechanics of convolute lamination in graded sand beds. *Geological Society of London Journal, v.* 134: 19 - 31.

Allen, J. 1982. *Sedimentary structures. Their character and physical basis. Development in sedimentology*. Elsevier scientific publishing company. Amsterdam - Oxford - New York: 593 p.

Allen, J. 1983. Studies in fluviatile sedimentation: bars, bar-complexes and sandstone sheets (low-sinuosity braided streams) in the brownstones (Devonian), welsh borders. *Sedimentary Geology, v.* 33: 237 - 293.

Allen, J.1985. Principles of Physical Sedimentology. Allen y Unwin (Eds), London: 272 p.

Alric, V., Haller, M., Feraud, G., Bertrand, H. y Zubia, M. 1996. Cronología $^{40}Ar/Ar^{39}$ del volcanismo Jurásico de la Patagonia Extrandina. *XIII Congreso Geológico Argentino y III Congreso de Exploración de Hidrocarburos, Actas* V: 243 – 250. Buenos Aires.

Amajor, I.1986. Alluvial fan facies in the Miocene-Pliocene coastal plain Sands, Niger delta, Nigeria. *Sedimentary Geology, v.* 49: 1 - 20.

Archer, A., Kvale, E. y Johnson, H. 1991. Clastic Tidal Sedimentology. En: D. G. Smith, G. E. Reinson, B. A. Zaitlin and R. A. Rahmani (eds). *Canadian Society of Petroleum Geologist. Memoir,* v. 16: 137 - 160.

Ardolino, A. L. y Franchi, M. 1996. Hoja Geológica 4366-I. Telsen. Provincia de Chubut. Subsecretaría de Minería de la Nación, Boletín v. 215: 110 p. Buenos Aires.

Aslan, A. y Blum, M. 1999. Contrasting styles of Holocene avulsion, Texas Gulf Coastal Plain. USA. En: Smith, N. y Rogers, J. (Eds.). *Fluvial Sedimentology VI*. Special Publication of International Association of Sedimentologists, v. 28: 193 - 210.

Bao, Ch. y Healy, T. 2002. Typhoon storm surge and some effects on muddy coasts. En: T. Healy, Y. Wang and J. A. Healy (Eds). *Muddy Coasts of the World: Processes, Deposits and Function.* Elsevier Science: 263 - 279.

Barcat, C., Cortiñas, J., Nevistic, V.A. y Zuchi, H. 1987. Cuenca Golfo de San Jorge. *X Congreso Geológico Argentino, Actas*, Vol. 5: 22 - 23. Tucumán.

Benson, R., Glaccum, R. y Noel, M. 1988. Geophysical techniques for sensing buried waste and waste migration. Technos Inc, USA: 91 - 116.

Bezerra, F. H., da Fonseca, V., Vita-Finzi, C., Lima-Filho, F. P. y Saadi, A. 2005. Liquefaction-induced structures in Quaternary alluvial gravels and gravelly sediments, NE Brazil. *Engineering Geology,* v. 76: 191 - 208.

Bjerg, E., Ntaflos, T., Tho, M., Aliani, P. y Labudia, C. 2009. Heterogeneous Lithospheric Mantle beneath Northern Patagonia: Evidence from Prahuaniyeu Garnet - and Spinel-Peridotites. Journal of petrology, V. 50, N 7: 1267-1298. doi:10.1093/petrology/egp021.

Black, L.P., Calver C.R., Seymour D.B. y Reed A. 2004. SHRIMP U–Pb detrital zircon ages from Proterozoic and Early Palaeozoic sandstones and their bearing on the early geological evolution of Tasmania. *Australian Journal of Earth Sciences,* v. 51: 885 - 900.

Blair, T. y McPherson, J. 1994. Alluvial fan and their natural distinction from river based on morphology, hydraulic processes, sedimentary processes and facies assemblages. *Journal of sedimentary Research, v.* 64: 450 - 489.

Blair, T. 2000. Sedimentology and progressive tectonic unconformities of the sheetflood-dominated Hell's Gate alluvial fan, Death Valley, California. Sedimentary Geology, v. 132: 233 - 262.

Bobachev, A., Modin, I. y Shevnin, V. 2000. IPI2WIN Software. Moscow State University. Moscov.

Bradford, M.R. y Wall, D.A. 1984. The distribution of Recent organic-walled dinoflagellate cysts in the Persian Gulf, Gulf of Oman, and northwestern Arabian Sea. Palaeontographica, Abteilung B 192: 16-84.

Bridge, J. 2006. Fluvial facies model recent developments. En: Posamentier H and Walker, H. (Eds), *Facies model revisited*. SEPM, Tulsa, Oklahoma: 527p.

Bristow, C., R. Skelly y F. Ethridge, 1999. Crevasse splay from rapidily aggradating, sand-bed, braided Niobrara River, Nebraska: effect of base level rise. *Sedimentology, v.* 46: 1029 - 1048.

Bunger, A. P. y Detournay, E. 2007. Early time solution for a penny-shaped hydraulic fracture. *Journal of Engineering Mechanics – ASCE*, v. 133: 534 -

540.

Cabaleri, N., Volkheimer, W., Armella, C.,Gallego, O., Silva Nieto, D., Páez, M., Cagnoni, M., Ramos, A., Panarello, H. y Koukharsk, M. 2010. Estratigrafía, análisis de facies y paleoambientes de la Formación Cañadón Asfalto en el depocentro jurásico Cerro Cóndor, Provincia del Chubut.

Callot, P., Odonne, F. y Sempere, T. 2008. Liquification and soft-sediment deformation in a limestone megabreccia: The Ayabacas giant collapse, Cretaceous, southern Peru. *Sedimentary Geology*, v. 212: 49 - 69.

Cortés, J.M. 1981. El sustrato precretácico del extremo nordeste de la provincia del Chubut. Revista de la Asociación Geológica Argentina 36(3):217-235.

Chamyal, L., Khadkikar, A., Malik, J. y Maurya, D. 1997. Sedimentology of the Narmada alluvial fan, western India. *Sedimentary Geology*: v. 107: 263 - 279.

Chebli, W., Nakayama, O., Sciutto, J. y Serraiotto, A. 1975. Estratigrafia del Grupo Chubut en la región central de la Provincia homónima. *VI Congreso Geológico Argentino, Actas* I: 375 - 392, Bahía Blanca.

Chernicoff, C.J., Santos, J., Zappettini, E.O. y Mcnaughton, N.J. 2007. Esquistos del Paleozoico inferior en la cantera Green (35°04´S - 65°28´O), sur de San Luis: edades U-Pb Shrimp e implicancias geodinámicas. *Revista de la Asociación Geologica Argentina, v.* 62: 154 - 158.

Chmura, G.L., Stone, P.A. y Ross, M.S. 2006. Non-pollen microfossils in Everglades sediments. *Review of Palaeobotany and Palynology* 141: 103-119.

Chunga, K., Livio, F., Michetti, A. y Serva, L. 2007. Synsedimentary deformation of Pleistocene glaciolacustrine deposits in the Albese con Cassano Area (Southern Alps, Northern Italy), and possible implications for paleoseismicity. *Sedimentary Geology, v.* 196: 59 - 80.

Comité Argentino de Estratigrafía 1992. Código Argentino de Estratigrafía. Serie B Nº 20. Asociación Geológica Argentina.

Codignotto, J., F. Nullo, J. Panza y C. Proserpio. 1978. Estratigrafía del Grupo Chubut entre Paso de Indios y Las Plumas, Provincia de Chubut, Argentina. *VII Congreso Geológico Argentino, Actas* II: 471 - 480. Neuquén.

Collinson, J., Mountney, N. y Thompson, D. 2006. Sedimentary structures. *Terra Publishing*, Harpenden, 292 p.

Corfu, F., Hanchar, J.M., Hoskin, P.W.O. y Kinny, P., 2003. Atlas of zircon textures: Reviews in Mineralogy and Geochemistry, Ch 16, v. 53: 469 - 500.

Cortiñas, J. 1996. La Cuenca de Somuncura-Cañadon Asfalto: Sus límites, ciclos evolutivos del relleno sedimentario y posibilidades exploratorias. *XIII Congreso Geológico Argentino y III Congreso de Exploración de Hidrocarburos, Actas* I: 147 - 163, Buenos Aires.

Costa, J.E., 1988. Rheologic, geomorphic, and sedimentologic differentiation of water floods, hyperconcentrated flows, and debris flows. En: V.R. Baker, R.C. Kochely EC. Patton, (Editors), *Flood Geomorphology*: 113 -122.

Cross, A.J., Claoué-Long J.C. y Crispe A.J. 2003. Summary of results. Joint NTGS-GA geochronology project: Tanami Region 2001–2002. Northern Territory Geological Survey, Record 2003 - 2006.

Cross, A. y Crispe, J. 2007. SHRIMP U–Pb analyses of detrital zircon: a window to understanding the Paleoproterozoic development of the Tanami Region, northern Australia. *Mineralium Deposita, v.* 42: 27 - 50.

Davies, D., Williams B. y Vessell, R. 1993. Dimensions and quality of reservoirs originating in low and high sinuosity channel systems, Lower Cretaceous Travis Peak Formation, East Texas, USA. En: North, C and Prosser, D. (Eds.), *Characterization of Fluvial and Aeolian Reservoirs. Geological Society Special Publication,* v. 73: 95 -121.

Davies-Vollum, K. y Graus, M. 2001. A relationship between alluvial backswamps and avulsion cycles: an example from the Willwood Formation of the Bighorn Basin, Wyoming. Sedimentary Geology, 140: 235 – 249.

Decho, A. 2000. *Microbial biofilms in intertidal systems: an overview .* Continental Shelf Research: 1257 - 1273.

Doyle, J. A., Jardiné, S., and Doerenkamp, A. 1982. *Afropollis*, a new genus of early angiosperm pollen, with notes on the Cretaceous palynostratigraphy of Northern Gondwana. *Bulletin Centre de Recherches Exploration-Production Elf-Aquitaine,* 6: 39–117.

Dreyer, T.1993. Quantified fluvial architecture in ephemeral stream deposits of the Es-plugafreda Formation (Paleocene), Tremp-GrausBasi, northern Spain. En: M. Marzoy C. Puigdefábregas (Eds.). Alluvial Sedimentation. *International Association of Sedimentologists, Special Publication, v.* 17: 337 - 362.

Duke, W.L., Arnott, R.W.C. y Cheel, R.J. 1991. Shelf sandstones and hummocky cross-stratification: new insights on a stormy debate. *Geology,* 19: 625 - 628.

Dypvika, H. y Jansa. 2003. Sedimentary signatures and processes during marine bolide impacts: a review. *Sedimentary Geology,* v. 161: 309 - 337.

Dypvika, H., Sandbakkenb, P., Postmac, G. y Mørkd, A. 2004. Early post-impact sedimentation around the central high of the Mjølnir impact crater (Barents Sea, Late Jurassic). *Sedimentary Geology,* v. 168: 227 - 247.

Eichhubl, P., y Behl, R.J. 1998. Diagenesis, deformation, and fluid flow in the Miocene Monterey Formation of coastal California. En: Eichhubl, P. (ed.) SEPM Pacific Section Special Publication, v. 83: 5 -13.

Fard, A. M. y Van Loon A. J. 2004. Deformation of an early Preboreal deposit at Nykvarn (SE Sweden) as a result of the bulldozing effect of a grounding iceberg. *Sedimentary Geology,* v. 165: 355 - 369.

Feraud, G., Alric, V., Bertrand, H., Haller, M. y Fornari, M. 1999. 40Ar/39Ar dating of the Jurassic volcanic province of Patagonia: migrating magmatism related to Gondwana break-up and subduction. *Earth and Planetary Science Letters,* v. 172: 83 - 96.

Fernandes, L. A., Castro, A. B. y Basilici, G. 2007. Seismites in continental sand sea deposits of the Late Cretaceous Caiuá Desert, Bauru Basin, Brazil. *Sedimentary Geology, v.* 199: 51 - 64.

Figari, E. y Courtade, S. 1993. Evolución Tectosedimentaria de la Cuenca Cañadón Asfalto, Chubut, Argentina. *XII Congreso Geológico Argentino y II Congreso de Exploración de Hidrocarburos,* Mendoza, *Actas* I: 66 - 77.

Figari, E., S. Courtade y Homovc J. 1992. Estructura de la Cuenca de Cañadón Asfalto. YPF, Comisión Geológica N^{o} 2 (*Inédito*): 56 p. Buenos Aires.

Figari, E. 2005. Evolución tectónica de la cuenca de Cañadón Asfalto (zona del valle medio del rio Chubut). Tesis doctoral. Biblioteca Digital de la Facultad de Ciencias Exactas y Naturales - Universidad de Buenos Aires. www.digital.bl.fcen.uba.ar.

Flores, R. 1981. Coal deposition in fluvial paleoenvironments of the Paleocene Tongue River Member of the Fort Union Formation, Powder River Area, Powder River Basin, Wyoming and Montana. En: Ethridge, F. y Flores, R. (eds.): Recent and Ancient Nonmarine depositional environment s: Models for exploration. Society of Economic Paleontologists and Mineralogists,

Special Publication 31: 169 - 190.

Foix, N., Paredes, J. y Giacosa R. 2008. Paleo-earthquakes in passive-margin settings, an example from the Paleocene of the Golfo San Jorge Basin, Argentina. *Sedimentary Geology,* v. 205: 67 - 78.

Fortes, M. 2002. Natural biological processes and controls. En: T. Healy, Y. Wang and J. A. Healy (Editors). *Muddy Coasts of the World: Processes, Deposits and Function.*Elsevier Science: 229 - 244.

Franchi, M., Haller, M., Lapido, O., Page, R. y Pesce, A. 1975. Geología de la región Nororiental de la Provincia de Chubut, Republica Argentina. II Congreso Iberoamericano de Geología Económica. Buenos Aires. T IV: 125 - 136.

Franzese, J., Spalletti, L. Gómez-Pérez, I. and Macdonald, D., 2003, Tectonic and paleoenvironmental evolution of Mesozoic sedimentary basins along the Andean foothills of Argentina (32°–54°S), *Journal of South American Earth Sciences* 2003 16(1): 81-90.

French, B. y Koeber, C. 2010. The convincing identification of terrestrial meteorite impact structures: What works, what doesn't, and why. *Earth-Science Reviews* v. 98: 123 - 170.

Gallego, O, Cabaleri, N., Armella, Volkheimer, W., Ballent, S., Martínez, S., Monferran, M., Silva Nieto, D. y Páez, M. 2011. Paleontology, sedimentology and paleoenvironment of a new fossiliferous locality of the Jurassic Cañadón Asfalto Formation, Chubut Province, Argentina. Journal of South American Earth Sciences 31: 54-68.

Gasparini, Z y de la Fuente M. 2000. Tortugas y plesiosaurios de la Formación La Colonia (Cretácico Superior) de Patagonia, Argentina. *Revista Española de Paleontología* 15: 23-35.

Gasparini, Z., Casadío, S., Fernández, M. y Salgado, L. 2001. Marine reptiles from the Late Cretaceous of northern Patagonia. *Journal of South American Earth Sciences* 14: 51-60.

Gehrels, G., Valencia, V. y Pullen, A. 2006, Detrital zircon geochronology by laser-ablation multicollector ICPMS at the Arizona Laserchron Center. En: Olszewski, T., y Huff, W. (Eds), *Geochronology: Emerging Opportunities*, Paleontological Society Short Course. Philadelphia, PA Paleontological Society Papers v. 11: 1-10.

Gehrels, G., Valencia V. y Ruiz, J. 2008. Enhanced precision, accuracy, efficiency, and spatial resolution of U-Pb ages by laser ablation–multicollector–inductively coupled plasma–mass spectrometry. *Geochemistry Geophysics Geosystems. An electronic journal of the earth sciences*. Published by AGU and the Geochemical Society, v. 9: 1-13.

Gehrels, G. 2009. Age peak program. University of Arizona. LaserChron Center. http://sites.google.com/a/laserchron.org/laserchron/home.

GEMOC. 2011. Geochemical Evolution and Metallogeny of Continents. Department of Earth and Planetary Sciences at Macquarie University http://www.gemoc.mq.edu.au/AnMethods/ AnlyticalMeth.html#5.6.

Gersib, G. y McCabe, B. 1981. Continental coal-bearing sediments of the Port Hood Formation (Carboniferous), Cape Lizee, Nova Scotia, Canada. En: Ethridge, F. and Flores, R. (Eds.), Recent and Ancient Nonmarine depositional environments: Models for exploration. *Society of Economic Paleontologists and Mineralogists*, Special Publication, v. 3: 95 - 108.

Ghiglione, M. C. 2002. Diques clásticos asociados a deformación transcurrente en depósitos sinorogénicos del Mioceno inferior de la Cuenca Austral. *Revista de la Asociación Geológica Argentina,* v. 57: 103 - 118.

Ghosh, P., Sarkar, S. y Maulik, P. 2006. Sedimentology of a muddy alluvial deposit: Triassic Denwa Formation, India. *Sedimentary Geology*, v. 191: 3 - 36.

González de Vallejo, L., Tsigé, M. y Cabrera, L. 2005. Paleoliquefaction features on Tenerife (Canary Islands) in Holocene sand deposits. *Engineering Geology,* v. 76: 179 - 190.

Gradstein, F. y Ogg, J. 2004. Geologic time scale 2004 – Why, how, and where next!. International Commission on Stratigraphy (ICS), Cambridge: 1 – 7.

Gruszka, B. y Van Loon, A.J. 2007. Pleistocene glaciolacustrine breccias of seismic origin in an active graben (central Poland). *Sedimentary Geology,* v. 186: 19 - 26.

Griffin, W.L., Belousova, E.A., Walters, S.G. and O'Reilly, S.Y. 2000. LAM-ICPMS analysis of detrital zircons: TerraneChron® applications in the Mt. Isa Eastern Succession. Report to BHP Exploration: 156 p.

Guy-Ohlson, D. 1992. *Botryococcus* as an aid in the interpretationof palaeoenvironment and depositional processes. *Review of Paleobotany and*

Palynology, 71: 1-15.

Hall, R.C.B. y Els. B.G. 2002. The origin and significance of load-induced deformation structures in soft-sediment and lava at the base of the Archaean Ventersdorp Supergroup, South Africa. *Journal of African Earth Sciences,* v. 35: 135 - 145.

Haller, M., Meister.A., Monti, A. y Weiler, N. 2000. Hoja 4366-II Puerto Madryn, Provincia del Chubut. Servicio Geológico Minero Argentino, Boletín 289. Buenos Aires.

Harms, J. C., Southard, J.B. y Walker, R.G. 1982. Structures and sequences in clastics rocks. Lectures notes for short course N^{o} 9, sponsored by the society of Economic Paleotologists and Mineralogist, USA: 249 p.

Hearn, C. 2008. The dynamics of coastal models. Cambridge University Press: 504 p.

Hernandez, J., Pujalte, V. y Robles, S. 1997. Los rizolitos de la Fm. Aguilar (Kimmeridgiense-Berriasiense, Palencia, Burgos y Cantabria): carcterizacion, genesis y significado. Geogaceta, 22, Bilbao: 93-96.

Hill, P. R., Meule´, S. y Longuépée, H. (2003), Combined-flow processes and sedimentary structures on the shoreface of the wave-dominated Grande-Riviere-de-la-Baleine delta, J. Sediment. Res., v. 73(2): 217 - 226.

Horváth, Z., Michéli, E., Mindszenty, A. y Berényi-Uveges, J. 2005. Soft-sediment deformation structures in Late Miocene–Pleistocene sediments on the pediment of the Mátra Hills (Visonta, Atkár,Verseg): Cryoturbation, load structures or seismites?. *Tectonophysics,* v. 410: 81 - 95.

Hoskin, P.W.O. y Schaltegger, U. 2003. The composition of zircon and igneous and metamorphic petrogenesis. En: Hanchar, J.M. y Hoskin, P.W.O. (eds.) *Reviews in Mineralogy and Geochemistry, Mineralogical Society of America,* v. 53: 27 - 62.

Jo, H. 2003. Depositional environments, architecture, and controls of Early Cretaceous non-marine successions in the northwestern part of Kyongsang Basin, Korea. *Sedimentary Geology,* v. 110: 51 - 79.

Jo, H. y Chough, S. 2001. Architectural analysis of fluvial sequences in the northwestern part of Kyongsang Basin (Early Cretaceous), Se Korea. *Sedimentary Geology,* v. 144: 307 - 334.

Jo, H. Rhee, C. y Chough, S. 1997. Sedimentary Geology Distinctive

characteristics of a streamflow-dominated alluvial fan deposit: Sanghoriarea, Kyongsang Basin (Early Cretaceous), southeastern Korea. *Sedimentary Geology*, v. 110: 51 - 79.

Kallmeier, E., Breitkreuz, C., Kiersnowski, H. y Geißler, H. 2010. Issues associated with the distinction between climatic and tectonic controls on Permian alluvial fan deposits from the Kotzen and Barnim Basins (North German Basin). *Sedimentary Geology,* v. 223: 15 - 34.

Kappla, C., 1980. Rhizoliths in terrestrial carbonates: classification, recognition, genesis and significance. *Sedimentology, v.* 27: 613 - 629.

Kay, S., Gorring, M. y Ramos, V. 2004. Magmatic sources, setting and causes of Eocene to Recent Patagonian plateau magmatism (36°S to 52°S latitude). *Revista de la Asociación Geológica Argentina,* v. 59: 556 - 568.

Kay, S., Ardolino, A, Gorring, L. y Ramos, V. 2007. The Somuncura Large Igneous Province in Patagonia: Interaction of a Transient Mantle Thermal Anomaly with a Subducting Slab. Journal of petrolog, V. 48, N 1: 43 - 77. doi:10.1093/petrology/egl053.

Kiiplia, E., Kiipli, T. y T. Kallastea, T. 2004. Bioproductivity rise in the East Baltic epicontinental sea in the Aeronian (Early Silurian). *Palaeogeography, Palaeoclimatology, Palaeoecology*, v. 205: 255 - 272

Kleinhans, M.G., Passchier, S. y Van Dijk, T. 2004. Marine Sandwave and River Dune Dynamics. *Enschede, The Netherlands*: v.2: 142 - 150.

Komarek, J. y Marvan, P. 1992. Morphological differences in natural populations of the genus Botryococcus (Chlorophyceae). *Archiv der Protistenkunde* 141: 65-100.

Kraus, M. y T. Wells, 1999. Recognizing avulsion deposits in the ancient stratigraphical record. En: Smith, N. y Rogers, J. (Eds.): *Fluvial Sedimentology VI*. International Association of Sedimentologists Special Publication, v. 28: 251 - 268.

Kwale, E. y Archer, A. 1991. Clastic Tidal Sedimentology. En: D. G. Smith, G. E. Reinson, B. A. Zaitlin y R. A. Rahmani (eds). *Canadian Society of Petroleum Geologist. Memoir*, v. 16: 179 -188.

Lapido, O. y Page, R. 1978. Relaciones estratigráficas y estructura del bajo de la Tierra Colorada, Provincia de Chubut. VII Congreso Geológico Argentino, Actas I: 299 - 313. Neuquén.

Lawton, S., Pollock, T. y Robinson, R. 2003. Integrating sandstone petrology and nonmarine sequence stratigraphy: application to the Late Cretaceous fluvial systems of Southwestern Utah, U.S.A. Journal of Sedimentary Research*, v.* 73: 389 - 406.

Le Heron, D.P., Sutcliffeb, O.E., Whittingtona, R.J. y Craigc. J. 2005. The origins of glacially related soft-sediment deformation structures in Upper Ordovician glaciogenic rocks: implication for ice-sheet dynamics. *Palaeogeography, Palaeoclimatology, Palaeoecology,* v. 218: 75 - 103.

LeMasurier, W, y Laudis, Ch, 1996, Mantle-plume activity recorded by low-relief erosion surfaces in West Antartica and New Zeland. GSA Bulletin, V. 108, N 11: 1450 - 1466.

Llambıas, E.J., Kleinman, L. y Salvarradi, J. 1993. El magmatismo Gondwanico. In: V.A. Ramos (Ed.), Geología y Recursos Naturales de Mendoza. XII Congreso Geológico Argentino y II Congreso de Exploración de Hidrocarburos, Mendoza, Relatorio: 53 - 64.

Lesta, P. 1968. Estratigrafía de la cuenca del Golfo San Jorge. III Jornadas Geológicas Argentinas, Actas I: 251 - 289. Buenos Aires.

Lesta, P. y Ferello, R. 1972. Región extraandina del Chubut y Norte de Santa Cruz. En: Leanza A.F (Ed.). Geología Regional Argentina. Academia Nacional de Ciencias: 601 - 653, Córdoba.

Lister, J.K. y Batten, D.J. 1988. Hurlandsia, a new non-marine Early Cretaceous dinocyst genus. Neues Jahrbuch für Geologie und Paläontologie. Monatshefte 8: 505-516.

Lopez Gamundi, O. 2006. Permian plate margin volcanism and tuffs in adjacent basins of west Gondwana: Age constraints and common characteristics. Journal of South American Earth Sciences, v. 22: 227 - 238.

Ludwig, K. 2003. User's Manual for Isoplot 3.0. A Geochronological Toolkit for Microsoft *Excel* Berkeley Geochronology Center Special Publication, v. 4: 1 - 71.

Lumsdon-West, M. y Guy Plint, A. 2005. Changing alluvial style in response to changing accommodation rate in a proximal foreland basin setting: Upper Cretaceous Dunvegan Formation, north-east British Columbia, Canada. *International Association of Sedimentologists, Special publication, v.* 35: 493 - 515.

Maltman, A. 1994. Introduction and overview. En: Maltman, A. (Ed.) *The geological deformation of sediments*, Chapman & Hall, London: 362 p.

Malumián, N. 1999. La sedimentación en la Patagonia Extraandina. In: *Geología Argentina* (Ed. R. Caminos). *Instituto de Geología y Recursos Minerales, Anales* 29: 557-612.

Malvicini, L. y Llambías E., 1974. Geología y génesis del depósito de manganeso Arroyo Verde, provincia del Chubut. V° Congreso. Geológico Argentino, Actas 2: 185-202, Buenos Aires.

Manassero, M, Zalba, P., Andreis, R. y Morosi, M. 2000. Petrology of continental pyroclastic and epiclastic sequences in the Chubut Group (Cretaceous): Los Altares-Las Plumas area, Chubut, Patagonia Argentina. *Revista Geológica de Chile, v.* 27: 13 - 26.

Marshall, J., 2000. Sedimentology of a Devonian faults-bounded braidplain and lacustrine fill in the lower part of the Skrinkle Sandstone, Dyfed, Wales. *Sedimentology, v.* 47: 325 - 342.

Martinsen, O., Ryshet, A., Helland-Hansen, W., Flesche, H., Torkisdsen, G. y Idil, S. 1999. Stratigraphic base level and fluvial architecture: Ericson sandstone (Campanian), rock spring uplift, SW Wyoming, USA. Sedimentology, v. 46: 235 - 259.

Maulik, P.K., Chakraborty, C., Ghosh, P., Rudra, y D., 2000. Meso- and macro-scale architecture of a Triassic fluvial succession: Denwa Formation, Satpura Gondwana basin, Madhya Pradesh. Journal of Geological Society of India, 56, 489 - 504.

Mc Carthy, I., Martini, P. y Leckiet, D. 1997. Anatomy and evolution of a Lower Cretaceous alluvial plain: sedimentology and palaeosols in the upper Blairmore Group, south-western Alberta, Canada. *Sedimentology,* v. 44: 197-220.

Medeanic, S. 2006. Freshwater algal palynomorph records from Holocene deposits in the coastal plain of Rio Grande do Sul, Brazil. *Review of Palaeobotany and Palynology* 141: 83-101.

Miall, A., 1977. A Review of the Braided-River Depositional Environment. *Earth-Science Reviews, v.* 13: 1 - 62.

Miall, A., 1985. Arquitectural-element analysis: a new method of facies analysis applied to fluvial deposits. *Earth Science Review, v.* 22: 261 - 308.

Miall, A. 1996. The Geology of Fluvial Deposits. Sedimentary Facies, Basin Analysis, and Petroleum Geology. Springer eds.: 582 p.

Miall, A., 2002. Architecture and sequence stratigraphy of Pleistocene fluvial systems in the Malay Basin, based on seismic timeslice analysis. *American Association of Petroleum Geology Bulletin, v.* 86: 1201 - 1216.

Miall, A. 2006. How do we identify big rivers? And how big is big. Sedimentary Geology, v. 186: 39 - 50.

Middleton, G.V. y Hampton, M.A. 1976. Subaqueous sediment transport and deposition by sediment gravity flows. En: Stanley, D.J. y Swift, D.J.P. (eds) *Marine Sediment Transport and Environmental Management*, John Wiley: 197 - 218, New York.

Mohaghegh, S., Balanb, B., Platon, V. y Ameri. S. 1999. Hydraulic fracture design and optimization of gas storage wells. *Journal of petroleum science and engineering,* v. 23: 161 - 171.

Mohrig, D., Heller, P.L., Paola, C., Lyons, W.J., 2000. Interpreting avulsion process from ancient alluvial sequences: Guadalope-Matarranya system (northern Spain) and Wasatch Formation (western Colorado). *Geological Society of America Bulletin, v.* 112: 1787 - 1803.

Montenat, C., Barrier, B., Ottd'Estevou, P. y Hibsch, C. 2007. Seismites: An attempt at critical analysis and classification. *Sedimentary Geology,* v. 196: 5 - 30.

Moretti, M. y Sabato, L. 2007. Recognition of trigger mechanisms for soft-sediment deformation in the Pleistocene lacustrine deposits of the Sant Arcangelo Basin (Southern Italy): Seismic shock vs. overloading. *Sedimentary Geology,* v. 196: 31 - 45.

Mörner, N. 2005. An interpretation and catalogue of paleoseismicity in Sweden. *Tectonophysics,* v. 408: 265 - 307.

Moss, S. J. y Howells, C. 1996. An anomalously large liquefaction structure, Oligocene, Ombilin Basin, West Sumatra, Indonesia. *Journal of Southeast Asian Earth Sciences,* v. 14: 71 - 78.

Müller, R., J. Nystuen y V. Wright, 2004. Pedogenic mud aggregates and paleosol development in ancient dryland river systems: criteria for interpreting alluvial mudrock origin and floodplain dynamics. *Journal of Sedimentary Research, v.* 74: 537 - 551.

Muñoz, A., Ramos, A., Sancez-Moya, y Sopena, A.1992. Evolving fluvial architecture during a marine transgression: Upper Buntsandstein, Triassic, central Spain. Sedimentary Geology v. 75: 257 - 281.

Murton, J. 2001. Thermokarst sediments and sedimentary structures, Tuktoyaktuk Coastl s, western Arctic Canada. *Global and Planetary Change,* v. 28: 175 - 192.

Musacchio, E. 1972. Carofitas del Cretacico inferior en sedimentitas chubutensis al este de La Herreria, Chubut. *Ameghiniana* 9: 354 - 356.

Musacchio, E. y Chebli, G.A. 1975. Ostrácodos no marinos y carófitas del Cretácico inferior en las provincias de Chubut y del Neuquén. *Ameghiniana v.* 12: 70 - 96.

Nakayama, C. 1972. Informe geológico preliminar de la región comprendida entre Lagunita Salada y CarhuéNiyeo al norte y Arroyo Perdido y Sierra Rosada al sur. Provincia de Chubut. YPF inédito. Buenos Aires.

Nakayama, C. 1975. Informe geológico preliminar del area que comprende sierra de los Chacays, cañadon Trapaulco, cerro Ponte y parte del curso inferior del arroyo Perdido. YPF inédito. Buenos Aires.

Nakayama, C., Sciutto, J. C., Castrillo, E. y Fernandez C. 1978. Contribución al conocimiento geológico del sector noreste de la provincia de Chubut. *VII Congreso Geológico Argentino, Actas* I: 657 - 670. Neuquén.

Nañez, C. y Malumián, N. 2008. Paleobiogeografía y paleogeografía del Maastrichtiense marino de la Patagonia, Tierra del Fuego y la Plataforma Continental Argentina, según sus foraminíferos bentónicos. *Revista Española de Paleontología,* v. 23: 273 - 300.

Nacional Ocean Service. 2000. Tide and Current Glossary. Silver Spring, MD: 1 - 34.

Navarro, E. 2008. Estudios de Exploración Geoelectrica sobre la Formación Marifil entre Puerto Madryn y Telsen (Provincia De Chubut). Revista Asociación Argentina de Geofísicos y Geodestas, v. 33: 77 - 88.

Navarro, E., C. Marcela Borel, V. Guler y Astini, R. 2008. Anatomía y facies asociadas a una superficie transgresiva en un mar epicontinental patagónico, Formación La Colonia, Telsen, Chubut. *XII Reunion Argentina de Sedimentología*, Buenos Aires, 126.

Nichols, G. 2005. Tertiary alluvial fans, at the northen margin of the Ebro Basin: a

review. En: Harvey, A., Mather, A. y Stokes, M. (Eds). *Alluvial fans: Geomorphology, sedimentology, dynamics.* Geological Society of London, Special Publication, v. 251: 187 - 205.

Nio, L y Chang Shu Yang, S. 1991. ClasticTidal Sedimentology. En: D. G. Smith, G. E. Reinson, B. A. Zaitlin y R. A. Rahmani (eds). *Canadian Society of Petroleum Geologist. Memoir, v.* 16: 3 - 11.

Obermeier, S. 1996. Use of liquefaction-induced features for paleoseismic analysis. An overview of how seismic liquefaction features can be distinguished from other features and how their regional distribution and properties of source sediment can be used to infer the location and strength of Holocene paleo-earthquakes. *Engineering Geology,* v. 44: 1 - 76.

Obermeier, S. 1998. Seismic liquefaction features: examples from paleosismic investigations in the continental United States. United States Geological Survey, Open File Report 98-488: http://pubs.usgs.gov/openfile/of98-488/.

Orellana, E. 1982. Prospección geoeléctrica en corriente continua. Segunda edición corregida y ampliada, Ed. Paraninfo, Madrid. : 579.

Ori, G. 1982. Braided to meandering channel patterns in humid region alluvial fan deposits, river Reno, Po plain (Northern Italy). *Sedimentary Geology, v.* 31: 231 - 248.

Ortner, H. 2007. Styles of soft-sediment deformation on top of a growing fold system in the Gosau Group at Muttekopf, Northern Calcareous Alps, Austria: Slumping versus tectonic deformation. *Sedimentary Geology,* v. 196: 99 - 118.

Page, R.; Ardolino, A.; De Barrio, R.E.; Franchi, M.; Lizuain, A.; Page, S.; Silva Nieto, D. 1999. Estratigrafía del Jurásico y Cretácico del Macizo de Somún Curá, Provincias de Río Negro y Chubut. *In*Geología Argentina (Caminos R.; editor). *Subsecretaría de Minería de la Nación, Servicio Geológico Minero Argentino, Instituto de Geología y Recursos Minerales, Anales* 29.

Pankhurst, R. y Rapela, C. 1995. Production of Jurassic rhyolite by anatexis of the lower crust of Patagonia.*Earth and Planetary Science Letters* 134: 23 - 26.

Pankhurst, R.J , Leat P.T., Sruoga, P.b,, Rapela, C.W., Marquez, M., Storey, B.C. y Riley, T.R. 1998. The Chon Aike province of Patagonia and related rocks in West Antarctica: A silicic large igneous province. *Journal of Volcanology and Geothermal Research,* v. 81: 113 - 136.

Pankhurst, R.J., Rapela, C.W., Fanning, C.M. y Márquez, M. 2006. Gondwanide continental collision and the origin of Patagonia. *Earth-Science Reviews,* v. 76: 235 - 257.

Papathanassiou, G. Pavlides, S., Christaras, B. y Pitilakis, K. 2005. Liquefaction case histories and empirical relations of earthquake. Magnitude versus distance from the broader Aegean region. *Journal of Geodynamics,* v. 40: 257 - 278.

Parkash, B., Awasthi, A. y Gohain, K. 1983. Lithofacies of the Markanda terminal fan, KurukShetran district, Haryana, India. Spec. Publs. Int. Ass. Sediment. v. 6: 337 - 344.

Pascual, R., Goin, F. J., González, P., Ardolino, A. y Puerta, P. 2000. A highly derived docodont from the Patagonian Late Cretaceous: evolutionary implications for Gondwanan mammals. *Geodiversitas*, 22: 395–414.

Pesce, A.H. 1978. Estratigrafía del Arroyo Perdido en su tramo medio e inferior, Provincia de Chubut. *VII Congreso Geológico Argentino*, *Actas II*: Actas 2: 315 - 333, Neuquén.

Petrinovic, I., Arnosio, J.M., Alvarado, G. E. y Guzmán, S. 2005. Erupciones freáticas sintectónicas en el campo geotérmico de Tocomar, Salta. Revista de la Asociación Geológica Argentina, 60 (1): 132- 141.

Plusagua, 2004. Pozo exploratorio a los efectos del abastecimiento de agua Bajo el Gualicho. Informe inédito. Bahia Blanca.

Poag, C. 1997. The Chesapeake Bay bolide impact: a convulsive event in Atlantic Coastal Plain evolution. *Sedimentary Geology,* v. 108: 45 - 90.

Posamentier, H. Y Allen, G. 1999. Siliciclastic sequence stratigraphy: concepts and applications. SEPM Concepts in Sedimentology and Paleontology N^0. 7: 210 p.

Prauss, M.L. 2006. The Cenomanian/Turonian Boundary Event (CTBE) at Wunstorf, north-west Germany, as reflected by marine palynology. *Cretaceous Research* 27: 872–886.

Proserpio, C. 1987. Descripción Geológica de Hoja 44c. Valle General Racedo, Provincia de Chubut. Servicio Geológico Nacional, Boletín 201. Buenos Aires.

Pross, J. and Brinkhuis, H. 2005. Organic-walled dinoflagellate cysts as paleo-environmental indicators in the Paleogene; a synopsis of concepts.

Paläontologische Zeitschrift 79: 53–59.

Ramos, V. 1978. El vulcanismo del Cretácico Inferior. *VII Congreso Geológico Argentino*, *Actas* I: 423 - 435. Neuquén.

Ramos, V. 2008. Patagonia: a paleozoic continent a drift?. Journal of South American Earth Sciences 26: 235–251. doi: 10.1016/j.jsames.2008.06.002.

Rapela y Pankhurst 1993. El volcanismo riolítico del noroeste de la Patagonia: Un evento meso-jurásico de corta duración y origen profundo. *XII Congreso Geológico Argentino y II Congreso de Exploración de Hidrocarburos,* Mendoza, *Actas* 4: 179 - 188.

Reading, H. 1996. *Sedimentary Environments:* Processes, Facies and Stratigraphy.*Blackwell Scientific Publications, Oxford*: 688 p.

Reineck, H. y Singh, I. 1986. Depositional sedimentary environmental. Springer – Verlag. Berlin: 549 p.

Retallack, G. 1976. Triassic paleosols in the Upper Narrabeen Group of New South Wales. Part I. Features of the paleosols. Journal of the Geological Society of Australia, v. 23: 383 - 399.

Retallack, G., 1990. *Soils of the past: an introduction to paleopedology*. Harper Collins Academic, Hammersmith: 520 p.

Riccardi, A.C., 1987. Cretaceous palaeogeography of southern South America. Palaegeography, Palaeoclimatology and Palaeoecology. 59: 169-195.

Riccardi, 1988. The Cretaceous system of southern South America. Geological Society of America, *Memoir* 168: 161pp.

Rodriguez-Lopez, J., Meléndez, N., Soria, A. R., Liesa, C. y Van Loon, A. 2007. Lateral variability of ancient seismites related to differences in sedimentary facies (the synrift Escucha Formation, mid-Cretaceous, eastern Spain). *Sedimentary Geology,* v. 201: 461 - 484.

Rodríguez-Pascua, M., Calvo, J.P., De Vicente, G. y Gómez-Gras, D. 2000. Soft-sediment deformation structures interpreted as seismites in lacustrine sediments of the Prebetic Zone, SE Spain, and their potential use as indicators of earthquake magnitudes during the Late Miocene. *Sedimentary Geology,* v. 135: 117 - 135.

Rossetti, D. y Santos Jr, E. 2003. Events of sediment deformation and mass failure in Upper Cretaceous estuarine deposits (Cametá Basin, northern Brazil) as evidence for seismic activity. *Sedimentary Geology,* v. 161: 107 -

130.

Rossetti, D., Bezerra, H., Góes, M. y Neves, B. 2010. Sediment deformation in Miocene and post-Miocene strata, Northeastern Brazil: Evidence for paleoseismicity in a passive margin. *Sedimentary Geology*, doi:10.1016/j.sedgeo.2010.02.005.

Scasso, R. y del Río, C. J. 1987. Ambientes de Sedimentación y Proveniencia de la Secuencia marina del Terciario superior de la peninsula Valdes. *Revista de la Asociación Geológica Argentina 42 (3-4): 291- 321*

Sánchez, M., Gomez, M. y Heredia, S. 2006. Sedimentología y paleoambientes del subgrupo Río Colorado (cretácico superior), Grupo Neuquén, en las bardas de la ciudad de Neuquén y alrededores. Revista de la Asociación Geológica Argentina 61 (2): 236-255.

Sánchez, M., Rossi, J., Morra, S. y Armas, P. 2008. Análisis estratigráfico secuencial de las formaciones Huincul y Lisandro del Subgrupo Rio Limay (Grupo Neuquen - Cretácico Tardio) en el departamento El Cuy, Rio Negro, Argentina. *Latin American Journal of Sedimentology and Basin Analysis, v.* 15: 1 - 26.

Sato, A., González, P., Basei, M. y Llambías, E. 2006. U-Pb ages of komatiitic rocks from Sierra de San Luis, Argentina. *5° South American Symposium on Isotope Geology,* Uruguay: 240 - 244.

Scasso, R. y del Rio, C.J. 1987. Ambientes de sedimentación y proveniencia de la secuencia marina del Terciario Superior de la región de península Valdés. *Revista de la Asociación Geológica Argentina* 42: 291 - 321.

Schieber, Juergen, J. Southard y K. Thaisen. 2007. Accretion of mudstone beds from migrating floccules ripples. *Science, v.* 318: 1760 - 1763.

Schumm, S. 1993. River response to base level change: implications for sequence stratigraphy. *Journal of Geology, v.* 101: 279 - 294.

Scientific Committee on Oceanic Research Working Group 106. En: T. Healy, Y. Wang and J. A. Healy (Eds). *Muddy Coasts of the World: Processes, Deposits and Function.* Elsevier Science: 1 - 19.

Sellés Martinez, J. 1996. Concretion morphology, classification and genesis. *Earth-Science Reviews,* v. 41: 177 - 210.

Sheth, H. 2007. Plume-related regional prevolcanic uplift in the Deccan Traps: Absence of evidence, evidence of absence. The Geological Society of

America. Special paper, 430: 785 - 813.

Shultz, A.W.1984. Subaerial debris-flow deposition in the Upper Paleozoic Cutler Formation, western Colorado. *Journal of Sedimentary Petrology,* 54: 759 - 772.

Simms, M.J. 2003. Uniquely extensive seismite from the latest Triassic of the United Kingdom: Evidence for bolide impact?. *Geology,* v. 31: 557 - 560.

Simms, M.J. 2007. Uniquely extensive soft-sediment deformation in the Rhaetian of the UK: Evidence for earthquake or impact? *Palaeogeography, Palaeoclimatology, Palaeoecology,* v. 244: 407 - 423.

Sims, J.D. 1975. Earthquake-induced structures in sediments of Van Norman Lake, San Fernando, California. *Science,* 182: 161 -163.

Singh, S y Jan, A. 2007. Liquefaction and fluidization of lacustrine deposits from Lahaul-Spiti and Ladakh Himalaya: Geological evidences of paleoseismicity along active fault zone. *Sedimentary Geology,* v. 196: 47 - 57.

Sluijs, A. y Brinkhuis, H. 2009. A dynamic climate and ecosystem state during the Paleocene-Eocene Thermal Maximum – inferences from dinoflagellate cyst assemblages at the New Jersey Shelf. *Biogeosciences Discuss*: 6: 5163–5215.

Sneh, A., 1983. Desert stream sequences in the Sinaí Peninsula. *Journal of Sedimentary Petrology, v.* 53: 1271 - 1279.

Sønderholm, M. y Tirsgaard, H. 1998. Proterozoic fluvial styles: response to changes in accommodation space (Rivieradal sandstones, eastern North Greenland). *Sedimentary Geology, v.* 120: 257 - 274.

Stear, W. 1983. Morphological characteristics of ephemeral stream channel and overbank splay sandstone bodies in the Permian Lower Beaufort Group, Karoo Basin, South Africa. En: Collinson, J.D., Lewin, J. (Eds.). *Modern and Ancient Fluvial Systems*. International Association of Sedimentologists, Special Publications, v. 6: 405 - 420.

Steel, RJ 1977 Triassic rift basins of north west Scotland: their configuration, infilling and development. In: Proceedings Northen North Sea Symposium (Eds Finstad k. G. and Selley P. Norwegian Petroleum Society. Oslo: 325 p.

Swift, D., Figueiredo, A., Freeland G. y Oertel G. 1983. Hummocky cross-stratification and megaripples; a geological double standard?. *Journal of Sedimentary Research, v.* 53: 1295 - 1317.

Tell, G. y Zamaloa, M. del C. 2004. A Miocene algal assemblage dominated by Pediastrum leonensis n. sp. (Chlorophyceae) from Patagonia, Argentina: paleoenvironmental implications. *Journal of Paleolimnology* 32: 247-254.

Therrien, F., 2005. Paleoenvironments of the latest Cretaceous (Maastrichtian) dinosaurs of Romania: insights from fluvial deposits and paleosols of the Transylvanian and Haþeg basins. Palaeogeography, Palaeoclimatology, Palaeoecology 218: 15-56.

Thomas, R.G., Smith, D.G., Wood, J.M., Visser, J., Calverley-Range, E.A. y Koster, E.H.1987. Inclined heterolithic stratification terminology, description, interpretation and significance. Sedimentary Geology, v. 53: 123 - 179.

Thorne, J. y Swift, D. 1991. Sedimentation on continental margins, VI: a regime model for depositional sequences, their component systems tracts and bounding surfaces. En: Swift, D., Oertel, G., Tilman, R. y Thorne, J. (Eds). International Association of Sedimentologists, Special Publications, v. 14: 189 - 255.

Tunbridge, I. 1981. Sandy high-energy flood sedimentation -- some criteria for recognition, with an example from the Devonian of S.W. England *Sedimentary Geology, v.* 28: 79 - 95.

Tyson, R.V. 1995. *Sedimentary organic matter. Organic facies and palynofacies*. Chapman and Hall (Eds), 615 p, London.

Udden, J. 1914. Mechanical composition of clastic sediments. En: Rocas Sedimentarias. Pettijohn, F. 1976. EUDEBA. Buenos Aires. p: 729.

Uliana, M.A. y Biddle, K.T. 1888. Mesozoic-Cenozoic paleogeographic and geodynamic evolution of southern South America. Revista Brasilera de Geociencias 18: 172-190.

Upadhyay, R. 2003. Earthquake-induced soft-sediment deformation in the lower Shyok river valley, northern Ladakh, India. *Journal of Asian Earth Sciences*, v. 21: 413 - 421.

Van Loon, A., 2002. Soft-sediment deformations in the Kleszczo´w Graben (central Poland). Sedimentary Geology, 147: 57– 70.

Van Loon, A. 2003. How ‘hard’ are hard-rock deformations? *Earth-Science Reviews,* v. 61: 181-188.

Van Wagoner, J.C., Mitchum, R.M., Campion, K.M. y Rahmanian V.D. 1990. Siliciclastic sequence stratigraphy in well logs, cores, and outcrops: concepts

for high-resolution correlation of time and facies. *American Association of Petroleum Geologists*, 7: 55 p.

Vander Velpen, B. 1988. Resist version 1.0. Software. ITC Msc. Research Project. Netherland.

Vrba, A. y Scasso, R. 2006. Geometría y facies basales de la transgresión "Entrerriense" en el NE del Chubut. IV Congreso Latinoamericano de Sedimentología y 11° Reunión Argentina de Sedimentología, Resúmenes 1: 242. San Carlos de Bariloche, Argentina.

Wall, D, Dale, B. Lohmann, G.P. and Smith, W.K. 1977. The environmental and climatic distribution of dinoflagellate cysts in modern marine sediments from regions in North and South Atlantic Oceans and adjacent areas. *Marine Micropaleontology* 2: 121-200

Vattuone, M. y Latorre, C., 2004. Edades K/Ar al este del cerro Nahuel Pan, Chubut. Implicancias en la correlacion del Grupo Divisadero y del Choiyoi en el área. *Revista de la Asociación Geológica Argentina, v.* 59: 510 - 513.

Vavra, G., Schmid, R. y Gebauer, D. 1999. Internal morphology, habit and U-Th-Pb microanalysis of amphibolite-to-granulite facies zircons: Geochronology of the Ivrea Zone (Southern Alps). *Contributions to Mineralogy and Petrology,* v. 134: 380 - 404.

Wagreich, M. y Strauss, P.E. 2006. Source area and tectonic control development in the Miocene FohnsdorIntramontane Basin, Austria. En: Harvey, A., Mather, A. y Stokes, M. (Eds). Alluvial-fan: Geomorphology, sedimentology and Dynamics. *Geological Society of London, Special publication, v.* 251: 207 - 216.

Wang, Y., Healy, T., Augustinus, P., Baba, M., Bao, C., Flemming, B., Fortes, M., Han, M., Marone, E., Mehta, A., Ke, X., Kirby, R., Kjerfve, B., Schaefer-Novelli, Y., y Wolanski, E. 2002. *Definition, properties, and classification of muddy coasts*. En: T. Healy, Y. Wang and J. A. Healy (Eds), Muddy Coasts of the World: Processes, Deposits and Function, Elsevier Science: 9 -18.

Well, S. y Harvey, A. 1987. Sedimentologic and geomorphic variations in storm-generated alluvial fans, Howgills fells, Norwest England. *Geological Society of America Bulletin,* v. 98: 182 -198.

Wentworth, C. K. 1922. A scale of grade and class term for clastic sediments. En: Rocas Sedimentarias. Pettijohn, F. 1976. EUDEBA. Buenos Aires. p: 729.

Wichmann, R. 1927. Sobre la Facies Lacustre Senoniana de los Estratos con Dinosaurios y su fauna. *Academia Nacional de Ciencias, Boletín* 30: 383 - 405. Córdoba.

Windhausen, A. 1921. Informe sobre un viaje de reconocimiento geológico en la parte nordeste del territorio del Chubut, con referencia especial a la cuestión de la provisión de agua a Puerto Madryn. Ministerio de Agricultura de la Nación. Dirección General de Minas, Geología e Hidrología, Boletin 24, Serie B (Geología), Buenos Aires: 101 p.

Williams, G. 1996. Soft-sediment deformation structures from the Marino an glacial succession, Adelaide foldbelt: implications for the palaeolatitude of late Neoproterozoic glaciations. *Sedimentary Geology,* v. 106: 165 - 175.

Williams, I. 2001. Response of detrital zircon and monazite, and their U–Pb isotopic systems, to regional metamorphism and host rock partial-melting, Cooma complex, southeastern Australia. *Australian Journal of Earth Sciences,* v. 48: 557 - 580.

Williams, C., Hills, L. y Krause, F. 1996. Preserved organics matter and miospores in buried Middle Devonian (Givetian) paleosols: indicators of weathering, oxidation and madurity. *Catena*: 28:1 - 19.

Williams, G.L., Brinkhuis, H., Pearce, M.A., Fensome, R.A. y Weegink, J.W. 2004. Southern Ocean and global dinoflagellate cyst events compared: index events for the Late Cretaceous–Neogene. In: *Proceedings of the Ocean Drilling Program, Scientific Results* 189, N.F. Exon, J.P. Kennett and M.J. Malone (eds), College Station, Texas: 1–98.

Wood, H.O. y Neumann, F. 1931. Modified Mercalli intensity scale of 1931. *Seismological Society of America,* v. 21: 277 - 283.

Yang, B., Dalrymple, R. W. y Chun, S. 2006. The Significance of Hummocky Cross-Stratification (HCS) Wavelengths: Evidence from an Open-Coast Tidal Flat, South Korea. *Journal of Sedimentary Research,* v. 76: 2 - 8.

Zavala, C., Arcuri, M., Gamero, H. Contreras, C. y Di Meglio M. 2010. A genetic facies tract for the analysis of coarse-grained hyperpycnal flow deposits. International Sedimentological Congress - Mendoza, Argentina, 2010., Res.: 938.

Zhody, A.R. 1973. A computer program for the automatic interpretation of Schlumberger sounding curves over horizontally stratified media geological

survey. Spriengfield. USA.

Zhody, A.R. 1989. A new method for the automatic interpretation of Schlumberger and Wenner sounding curves. *Geophisycs,* v. 54: 245 - 253.