Rivista Italiana di Paleontologia e Stratigrafia	volume 115	no. 1	pp. 133-134	March 2009

SHORT NOTES – NOTE BREVI

DISCUSSION ON THE PAPER: "THE GEOLOGICAL RECORD OF THE OLDEST HISTORICAL TSUNAMIS IN SOUTHWESTERN SPAIN" BY FRANCISCO RUIZ, MANUEL ABAD, JOAQUÍN RODRÍGUEZ VIDAL, LUIS MIGUEL CÁCERES, MARÍA LUZ GONZÁLEZ-REGALADO, MARÍA ISABEL CARRETERO, MANUEL POZO & FRANCISCO GÓMEZ TOSCANO, PUBLISHED IN RIVISTA ITALIANA DI PALEONTOLOGIA E STRATIGRAFIA, 114(1): 147-156 (2008)

ANTONIO RODRÍGUEZ-RAMÍREZ

As a researcher working in Doñana National Park (south-western Spain) I would like to made some comments on the paper "The Geological record of the oldest historical tsunamis in southwestern Spain" by Francisco Ruiz, Manuel Abad, Joaquín Rodríguez Vidal, Luis Miguel Cáceres, María Luz González-Regalado, María Isabel Carretero, Manuel Pozo & Francisco Gómez Toscano.

In the first place, this study is based on a multidisciplinary geological analysis of a single, short and narrow (2 cm) core, collected in Doñana National Park (SW Spain). This core has already been published in a previous paper (Ruiz et al. 2004), in which I was a close collaborator. The analysis presented in the new paper is exactly the same, in terms of number of samples, their location and the methodology, as in the 2004 publication, and in this sense no new contributions are made. The conclusions reached in the latest paper (Ruiz et al. 2008) are based exclusively on those results.

In Ruiz et al. (2004), the vertical evolution of this core suggests a progressive emersion from an initial shallow, high brackish lagoon to a final, supratidal high marsh. The final part of the core comprises a chenier. The different methodologies applied do not allow any phases to be differentiated within the chenier formation. This chenier is described as an accumulation of "massive beds" of estuarine and marine species transported during high events towards the inner estuary. This paper states, quite correctly, that the cause of these accumulations cannot be determined for certain, and may be owing to storms, tsunami or high tides.

In Ruiz et al. (2008), despite failing to provide any new results, the authors firmly claim that this chenier was produced not by one but by two tsunami. In this paper they are able to differentiate two phases in the accumulations of invertebrate shells (chenier), whereas in Ruiz et al. (2004) they only distinguish "massive beds" without being able to observe any sedimentary structures. It is impossible to recognise a "rafted" disposition of shells in a 2 cm core, without carrying out complementary stratigraphic and morpho-sedimentary studies. A short narrow core does not allow greater sedimentological differentiation, as was deduced in the 2004 paper.

In addition, the paper attempts to support this claim by comparing the chenier with other sedimentary formations with very different characteristics. A Chenier ridge cannot be compared with the high energy episodes, within clayey sequences, studied by Lario et al. (2000, 2002). In the same way, the tsunamigenic formations studied by Goff et al. (2001) bear no relation to the chenier ridges of the Doñana marshland. Equally, it is not true that in Augustinus (1989) the chenier ridges were said to be produced by tsunamis, as stated by Ruiz et al. (2008). The process introducing the sedimentary supplies into the basin is one thing and the various causes (waves, littoral current, high tides..) that generate the chenier ridges are another very different thing.

There are some characteristics that are common to many of the tsunami deposits described in the published literature (e.g., Dawson et al. 1991; Foster et al. 1991; Atwater & Moore 1992; Minoura & Nakata 1994; Nelson et al. 1995; Bondevik et al. 1997; Dawson & Smith 2000; Goff et al. 2000; Sawai 2002; Nichol et al. 2003; Goff et al. 2004), however, in none of the published studies are chenier ridges given as direct evidence for tsunamigenic processes.

As numerous papers make clear (Augustinus 1969; Hoyt 1969; Otvos & Price 1979; Otvos 2000; McBride et al. 2007), a chenier is a beach ridge (long, narrow, linear and curvilinear) resting on silty or clayey deposits, which becomes isolated from the shore by a band of tidal mudflats. The high energy events supplied sand and shells from the estuary upstream. Later, wave-winnowing reworking concentrated the sediments (sand and shells) to form a longshore bar or ridge (chenier) which was driven shoreward with intense landward migration, by wash-over processes, attached to and on top of the highest relief, the fluvial levees, until the crest had reached a level sufficiently high to resist flooding even during storms or the highest spring tides. The cheniers at Doñana match these parameters (Rodríguez Ramírez et al. 2001; Rodríguez-Ramírez & Yáñez-Camacho 2008).

From the morphosedimentary, palaeontological and lithostratigraphic study of the Guadalquivir estuary spits and cheniers, it is not possible to determine with certainty whether the detrital supplies came from storms, tsunamis, or high tides, etc. The Guadalquivir estuary cheniers are the result of the reworking and subsequent deposit of these materials (Rodríguez-Ramírez & Yáñez-Camacho 2008). For this rea-

Departamento de Geodinámica y Paleontología, Univ. de Huelva, Avda. Fuerzas Armadas, s/n. 21071-Huelva (Spain). E-mail: arodri@uhu.es

son, they cannot be considered as direct evidence to distinguish one event from another. The chenier ridge is indirect evidence of a series of factors.

Following the Malaysian tsunami in 2004, the study of this type of phenomena has increased considerably, as since then the authorities have considered it a priority line of research. This has caused certain colleagues in the scientific community to search for the slightest evidence, however unlikely it might be, in order to benefit from the abundant resources the administration has made available to scientific institutions. However, it is pertinent to demand greater rigor in their studies, regardless of fashions. We do science or we use it for our own ends.

REFERENCES

Augustinus P.G.E.F. (1989) - Cheniers and cheniers plain: A general introduction. *Mar. Geol.,* 90: 219-229, Amsterdam.

Atwater B.F. & Moore A.L. (1992) - A tsunami about 1000 years ago in Puget Sound, Washington. *Science*, 258: 1614-1617, Washington.

Bondevik S., Svendsen J.I. & Mangerud J. (1997) - Tsunami sedimentary facies deposited by the Storegga tsunami in shallow marine basins and coastal lakes, western Norway. *Sedimentology,* 44: 1115-1131, Hoboken.

Dawson S. & Smith D.E. (2000) - The sedimentology of mid-Holocene tsunami facies in northern Scotland. *Mar. Geol.,* 170: 6979, Amsterdam.

Dawson A.G., Foster I.D.L., Shi S., Smith D.E. & Long D. (1991) - The identification of tsunami deposits in coastal sediment sequences. *Sci. Tsunami Haz.,* 9: 73-82, Ewa Beach.

Foster I.D.L., Albon A.J., Bardell K.M., Fletcher J.L., Jardine T.C., Mothers R.J., Pritchard M.A. & Turner S.E. (1991) - High energy coastal sedimentary deposits; an evaluation of depositional processes in southwest England. *Earth Surf. Proces. Landf.,* 16: 341-356, Hoboken.

Goff J.R., Rouse H.L., Jones S.L., Hayward B.W., Cochran U., McLea W., Dickinson W.W. & Morley M.S. (2000) - Evidence for an earthquake and tsunami about 3100-3400 yr ago, and other catastrophic saltwater inundations recorded in a coastal lagoon, New Zealand. *Mar. Geol.,* 170: 231-249, Amsterdam.

Goff J., Chague′-Goff C. & Nichol J. (2001) - Palaeotsunami deposits: a New Zealand perspective. *Sedim. Geol.,* 143: 1-6, Amsterdam.

Goff J., McFadgen B.G. & Chague′-Goff C. (2004) - Sedimentary differences between the 2002 Easter storm and the 15th-century Okoropunga tsunami, southeastern North Island, New Zealand. *Mar. Geol.,* 204: 235-250, Amsterdam.

Hoyt J.H. (1969) - Cheniers versus barrier, genetic and stratigraphic distinction. *Bull. Am. Assoc. Petr. Geol.,* 53: 299-306, Tulsa.

Lario J., Zazo C., Plater J., Goy J.L., Dabrio C.J., Borjs F., Sierro F.J. & Luque L. (2000) - Particles size and magnetic properties of Holocene estuarine deposits from the Doñana Nacional Park (SW Iberian): evidence of gradual and abrupt coastal sedimentation. *Z. Geomorphol.,* 45: 33-54, Stuttgart.

Lario J., Spencer C., Plater J., Zazo C., Goy J.L. & Dabrio C.J. (2002) - Particle size characterisation of Holocene backbarrier sequences from North Atlantic coasts (SW Spain and SE England). *Geomorphology,* 41: 25-42, Göttingen.

McBride R.A., Taylor J.T. & Byrnes M.R. (2007) - Coastal morphodynamics and Chenier-Plain evolution in southwestern Lousiana, USA: A geomorphic model. *Geomorphology,* 88: 367-422, Göttingen.

Minoura K. & Nakata, T. (1994) - Discovery of an ancient tsunami deposit in coastal sequences of southwest Japan: verification of a large historic tsunami. *The Island Arc,* 3: 66-72, Hoboken.

Nelson A.R., Atwater B.F., Bobrowsky P.T., Bradley L., Clague J.J., Carver G.A., Darienzo M.E., Grant W.C., Krueger H.W., Sparks R., Stafford T.W. & Stuiver M. (1995) - Radiocarbon evidence for extensive plate-boundary rupture about 300 years ago at the Cascadia subduction zone. *Nature,* 378: 371-374, London.

Nichol S.L., Lian OB. & Carter C.H. (2003) - Sheet-gravel evidence for a late Holocene tsunami run-up on beach dunes, Great Barrier Island, New Zealand. *Sedim. Geology*, 155: 129-145, Amsterdam.

Otvos E.G. & Price W.A. (1979) - Problems of chenier genesis and terminology-an overview. *Mar. Geol.,* 31: 251-263, Amsterdam.

Otvos E. (2000) - Beach ridges-definitions and significance. *Geomorphology,* 32: 83-108, Göttingen.

Rodríguez-Ramírez A, Cáceres L.M., Ruiz F., Rodríguez Vidal, J. (2001) - Los "cheniers" del estuario del Guadalquivir. Actas de la V Reunion del Cuaternario Ibérico, p. 226-229. Lisboa.

Rodríguez-Ramírez A. & Yáñez-Camacho C.M. (2008) - Formation of Chenier Plain of the Doñana marshland (SW Spain): Observations and geomorphic model. *Mar. Geol.,* 254(3-4): 187-196, Amsterdam.

Ruiz F, Rodríguez-Ramírez A, Cáceres, L.M., Rodríguez vidal, J., Carretero, M.I., Clemente, L., Muñoz, J.M. y Yañez, C. (2004) - Late Holocene evolution of the southwestern Doñana National Park (Guadalquivir Estuary, SW Spain): a multivariate approach. *Palaeogeogr. Palaeoclimatol. Palaeoecol.*, 204: 47-64, Amsterdam.

Sawai Y. (2002) - Evidence for 17th-century tsunamis generated on the Kuril-Kamchatka subduction zone, Lake Tokotan, Hokkaido, Japan. *J. Asian Earth Sci.,* 20: 903-911, Amsterdam.