Quaternary Science Reviews 124 (2015) 84–105

Contents lists available at ScienceDirect

Quaternary Science Reviews

journal homepage: www.elsevier.com/locate/quascirev

The quaternary coversands of southwest France

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ARTICLE INFO

Article history:
Received 20 February 2015
Received in revised form
11 June 2015
Accepted 19 June 2015
Available online 21 July 2015

Keywords:
Coversand
Southwest France
OSL
ESR
Middle and Late Pleistocene
Palaeosols

ABSTRACT

Detailed stratigraphic analysis and numerical dating (OSL, IRSL, ESR, 14C) of Pleistocene coversands in southwest France enable the construction of a renewed chronostratigraphic framework for sand deposition. The chronological data obtained from sandsheet units testify to the development of transgressive dunefields since at least the Middle Pleistocene (MIS 10). Three main phases of accumulation occurred during the Last Glacial. The oldest one (64–42 ka) is associated with wet sandsheet facies, histic horizons and zibar-type dune fields, which reflect deposition in a context strongly influenced by the groundwater table. The Late Pleniglacial (24–14 ka) corresponds to the main phase of coversand extension in a drier context. Silty gley horizons suggest, however, local interruptions of sand drifting during GS 2.1. Late-glacial stabilization of the coversands may not have occurred before GI-1c (Allerød), which was typified by the development of cumulic arenosols. These were covered by parabolic dunes during the Younger Dryas. The variations in extent of the emerged continental shelf during the glacial–interglacial cycles may explain the uneven geographical distribution of sand deposition through time. Because of coastline retreat up to 100 km north of 45°N during the LGM lowstand, the coversands were unable to reach the northern part of the basin. Comparison with other European regions highlights stronger affinities of the French record with Portugal than with the Netherlands and Great Britain, probably because of reduced influence of permafrost.

1. Introduction

Coversands are typically sandy deposits of cold-climate (periglacial) aeolian origin formed into a flat spatially continuous relief of roughly uniform thickness. In northern Europe, a large coversand belt developed at the end of the last glaciation south of the British-Scandinavian ice sheet. Widespread sand deposits of the Late Weichselian and Lateglacial age are documented in the Netherlands (Van der Hammen and Maarveld, 1952; Dücker and Maarveld, 1957; Van der Hammen and Wijmstra, 1971a, b; Vandenberghe, 1991, 1993; Kasse, 1999, 2002; Van Huissteden et al., 2000; Vandenberghe and Kasse, 2008), Belgium (De Moor and Heyse, 1978; De Moor, 1981; Paulissen and Munaut, 1969; Vandenberghe and Gullentops, 1977; Vandenberghe, 1983) Germany (Koster, 1988; Schwan, 1986, 1988), Poland (Kozarski, 1990; Kozarski and Nowaczyk, 1991; Manikowska, 1991), Denmark (Kolstrup, 1982, 1991; Kolstrup et al., 2007), Sweden and Finland (Van Vliet-Lanoë et al., 1993; Seppälä, 1995; Käyhkö et al., 1999). Patchy coversands are also found in England (Catt, 1977; Bateman, 1995, 1998) and northwest France (Lautridou, 1985; Antoine et al., 2003). The main lithofacies have been described (Ruegg, 1983; Schwan, 1986, 1988; Kasse, 1999, 2002) and a chronostratigraphic framework has been established based on radiocarbon and luminescence ages (Van der Hammen and Wijmstra, 1971a,b; Van Geel et al., 1989; Van

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http://dx.doi.org/10.1016/j.quascirev.2015.06.019
0277-3791/

Huissteden, 1990; Kasse, 2002). These studies benefited from steady improvement of depositional models in periglacial deserts during the last decades (Koster and Dijkmans, 1988; Dijkmans and Koster, 1990; Dijkmans and Törnqvist, 1991; Mountney and Russell, 2004, 2009). Pleistocene coversands also developed in Europe farther from the ice sheets in less severe periglacial or cold temperate environments, mainly along the Atlantic coast of southwest France (Legigan, 1979; Bertran et al., 2011) and Portugal (Granja et al., 2008; Thomas et al., 2008) or inland, in Spain (Rendell et al., 1994; Bateman and Van Huissteden, 1999; Bateman and Herrero, 2001; Bernat Rebollal and Pérez-González, 2008; Rebollal, 2013). The Landes de Gascogne, a ca. 13.000 km^2 area located in the Aquitaine Basin (southwestern France), constitutes the most extensive example.

Aeolian deposits in the Landes de Gascogne area have long been recognized (reviewed in Sitzia, 2014) and have been distinguished as an original geological formation, called the Sable des Landes Formation by Legigan (1979). First lithostratigraphic data combined with luminescence and radiocarbon dating have been provided by Bertran et al., 2009, 2011). Most of the outcrops studied by these authors are restricted to the southeastern part of the Sable des Landes Formation (Fig. 1), in an area where the thickness of the coversands is rather low, hence the sequence may not be representative of the entire formation.

The aim of this paper is to give a comprehensive stratigraphic overview of the formation, through the study of 17 new outcrops (Figs. 3, 4 and 9) distributed throughout the region (Fig. 1). This allows a more appropriate comparison with the northern coversands and a better evaluation of the main factors controlling the aeolian system.

2. Geological setting

The Aquitaine Basin is bordered by the Hercynian Massif Armoricain and Massif Central to the north and the east, respectively (Vigneaux, 1975), as well as the Cenozoic Pyrenean chain to the south (Serrano et al., 2006). Jurassic and Cretaceous limestones form large centripetal aureoles, while Tertiary and Quaternary deposits (mainly continental and marine coastal formations) lie in the centre of the basin.

From the Middle Miocene to the Middle Pleistocene, the basin was filled by fluvial deposits (Vigneaux, 1975; Dubreuilh et al., 1995) and a large deltaic body (the Landes delta) composed of five major fining-upward sequences. From the bottom to the top, these are: the *Sables Fauves* Formation (Langhian-Serravallian) followed by the *Glaises Bigarrées* Formation (Tortonian) (sequence 1), the *Arengosse* Formation (Pliocene, sequences 2 and 3), the *Onesse* Formation (Early Lower Pleistocene, sequence 4), and the *Belin* Formation (Lower Pleistocene, sequence 5) (Dubreuilh et al., 1995).

The palaeogeographic reconstruction proposed by the latter authors indicates that the depocentre progressively shifted northward (Fig. 2a). During the Lower Pleistocene, the delta was limited to the *Plateau Girondin* (Fig. 2a), and the latter *Belin* Formation formed a corridor subparallel to the current Garonne River. River incision started during the Lower Pleistocene, as for the other main rivers in the region (Dromne, Isle, Dordogne, Lot, Adour) (Fig. 2a).

The final phase of deposition (Middle to Late Pleistocene) comprises the *Castets* Formation and the *Sable des Landes* Formation ((Dubreuilh et al., 1995) (Fig. 2b–c). Both lie unconformably on older deposits and form a triangular wedge in the centre of the basin, the thickness of which decreases from the ocean landward.

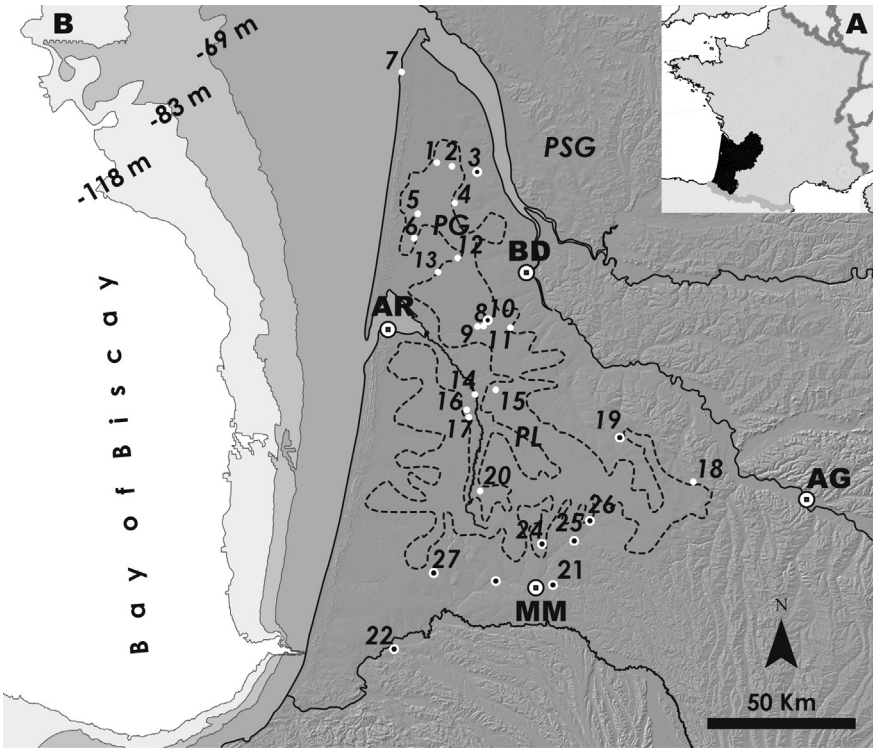

Fig. 1. A. Location of studied region (black area) B. Main areas investigated and location of the outcrops. 1 Hourtin; 2 Plaine du Jonc; 3 St-Laurent Médoc; 4 Brach; 5 Cabaley; 6 Canal de Caupos; 7 Le Gurp; 8 Pot-Au-Pin; 9 Les Gargails; 10 Les-Pins-de-Jarry; 11 Saucats; 12 Camp de Sauge; 13 Lanton; 14 Belin-Beliet; 15 Larrousey; 16 Saugnacq-et-Muret; 17 Locbeilh; 18 Fargues-sur-Ourbise; 19 Lerm-et-Musset; 20 Sabres; 21 Saint-Criq; 22 Dax-Golf; 23 Cabannes; 24 Bois-de-Marsacq; 25 Roquefort; 26 Retjons; 27 Rion-des-Landes. Dashed line: present wet heathlands, modified after Papy (1977). PG -Plateau Girondin; PL-Plateau Landais; PSG-Plateau Saintonge Girondine. White filled circles: unpublished sections; Black circles with white outline: published sections; Unfilled black circles: main towns. Marine contours from http://www.emodnet.eu/bathymetry –118 m (~24 ka); –83 m (~56 ka); –69 m (~13 ka). AG- Agen; AR- Arcachon; BD- Bordeaux; MM- Mont-de-Marsan.