Stratigraphic Terminations of the Eocene-Oligocene Annot Sandstone, Southeastern France

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GCAGS Explore & Discover Article #00233*
http://www.gcags.org/exploreanddiscover/2017/00233_rotzien.pdf
Posted October 30, 2017.

*Article based on an extended abstract published in the *GCAGS Transactions* (see footnote reference below), which is available as part of the entire 2017 *GCAGS Transactions* volume via the GCAGS Bookstore at the Bureau of Economic Geology (www.beg.utexas.edu) or as an individual document via AAPG Datapages, Inc. (www.datapages.com), and delivered as an oral presentation at the 67th Annual GCAGS Convention and 64th Annual GCSSEPM Meeting in San Antonio, Texas, November 1–3, 2017.

EXTENDED ABSTRACT

The Eocene-Oligocene Annot Sandstone (Grès d'Annot) in southeastern France consists of an assemblage of clastic deposits interpreted here to represent common deepwater depositional elements including channels, levees, splays, and overbank, as well as a diverse group of stratigraphic intervals that onlap many of the sub-basin margins (Fig. 1). These stratigraphic intervals exposed in mountainous Alpine outcrops are well suited to evaluate sediment gravity flow transport and deposition along a spectrum of deepwater depositional margins where stratigraphic intervals laterally terminate. There are three main classes of lateral stratigraphic terminations recognized in the Annot Sandstone based on scale: sub-basin-margin scale at 10s to 100s of meters in thickness, typically exposed as lapout geometries; depositional element scale on the order of 10s of meters thick for channels, splays, levees, and overbank deposits; and intra-depositional element scale typically <10 meters thick. Most of the lateral terminations in the Annot Sandstone are comprised of one or more type of lithofacies (Fig. 2): thick- to very thick-bedded, structureless, coarse-grained to conglomeratic sandstone beds interpreted as high-density turbidity current deposits (Ta division, Bouma, 1962; S3 division, Lowe, 1982); thin- to medium-bedded predominantly planar laminated to ripple cross-laminated sandstone and associated mudstone interpreted as low-density turbidity current deposits (Bouma Tbcde); and deformed and contorted mudstone-rich beds interpreted as debris-flow, slurry-flow (M2,3,5 divisions, Lowe and Guy, 2000), and hybrid-flow deposits (H2–3 divisions, Haughton et al., 2009). The sedimentation units show complex geometries at outcrop scale: abrupt termination, maintaining their original thickness until very close to their margin (<1–2 meters); subtle onlap, in which beds taper their thickness over <10 meters; and drape, in which beds maintain thickness onto and along a margin over 10s of meters. Regardless of the class, and within close proximity to a margin, most of the beds show a reduction in grain size and bed thickness and an increase in the abundance of sedimentary structures. Some of the ripple cross-laminated divisions (Bouma Tc) record changes in paleocurrent direction within the same bed. Slumped, disturbed to completely overturned bedding, and intrabasinal mudstone clasts are common in the thicker, coarse-grained to conglomeratic beds. At least five main

Originally published as: Rotzien, J. R., 2017, Stratigraphic terminations of the Eocene-Oligocene Annot Sandstone, southeastern France: Gulf Coast Association of Geological Societies Transactions, v. 67, p. 529–532.

factors influence how a sediment-gravity flow deposit ends laterally in the Annot Sandstone: confinement originating from subtle basin-floor topography; confinement due to sub-basin-margin geometry; erosional and incisional processes; the lack of sediment supply; and the lack of sediment-gravity flow energy. Bed thickness analysis indicates that the most common type of pattern at large-scale margins is a thickening upward trend: thin-bedded sandstone and mudstone deposited by low-density turbidity currents; medium- to thick-bedded sandstone and mudstone deposited by high- and low-density turbidity currents; and finally, thick- to very thick-bedded sandstone deposited by predominantly high-density turbidity currents. This trend is thought to form mainly from the response of increased sediment volume and concentration of the sediment gravity flows interacting with a margin. The Annot Sandstone provides a remarkable window to the sedimentation processes and stacking patterns associated with stratigraphic terminations that occur at a variety of deepwater depositional margins.

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