

Regional stages: What is the use of them – A case study in Lebanon

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In Lebanon, the lithostratigraphic succession established by DUBERTRET (1963) – and the units of which were later renamed by WALLEY (1997) – comprises from base to top the J7 (“Salima Fm”), the C1 (“Chouf Sandstone Fm”), the C2a (“Abeih Fm”), the C2b (“Mdairej Fm”) and the C3 (“Hammana Fm”). DUBERTRET ascribed J7 to the uppermost Jurassic (excluding the Tithonian and the Berriasian), C1 to the “Néocomien” (possibly comprising the Barremian), C2 to the Aptian (a for the lower part, b for the upper part), and C3 to the Albian. All these mappable units are facies-driven, diachronous units: it is suggested to call them “FACIES”, not formations. Because the depositional environments are not favorable, there were very few records of ammonites (merely some *Knemiceras* in the C3), calpionellids or planktonic foraminifers: accordingly a direct implementation of the standard chronostratigraphic units, i.e., the international stages, is not feasible – such as in most non-basinal Cretaceous sections where these index fossils are lacking. MAKSOUD et al. (2014) and GRANIER et al. (2016) identified a number of significant unconformities, which led to the identification of genuine unconformity-bounded units: we call them “FORMATIONS”. Accordingly the revised Dubertret’s succession comprises the “Couches jaunes supérieures” Fm (an oolitic unit) separated by a karst surface from the overlying “Grès du Liban” Fm, followed by the “Falaise de Jezzine” Fm that is also a unit framed by two sequence boundaries (note: each of these SB is merged with its associated transgressive surface as it is often the case with shallow-water settings). In addition to the recent finding of Bedoulian ammonites (MAKSOUD et al., 2014) above the upper unconformity of “Falaise de Jezzine”, which indicates this last unit is slightly older than previously assumed, rich micropaleontological assemblages (benthic foraminifers and Dasycladales) make it possible to biostratigraphically characterize each of the above units: we call them “REGIONAL STAGES”. In non-basinal settings, which lack the classical index fossils, these regional stages – neither facies, nor formations – are the mandatory step in the correlation process with the international standard stages. As a result of this approach, the gathering of the lithostratigraphic and biostratigraphic information led to ascribe the “Couches jaunes supérieures” to the Valanginian stage (with the identification of significant hiatuses below and above them), the “Grès du Liban” to the Barremian, and the “Falaise de Jezzine” (or Jezzinian regional stage) to the transition Barremian–Aptian; the transgressive strata above the latter starts in the lower Aptian.

DUBERTRET, B., 1963. *Lexique Stratigraphique International*, III/10 c1, 7–155.

GRANIER, B. et al., 2016. *Carnets Geol.*, **16/8**, 247–269.

MAKSOUD, S. et al., 2014. *Carnets Geol.*, **14/18**, 401–427.

WALLEY, C.D., 1997. *Lebanese Science Bulletin*, **10/1**, 81–108.