

# LENTICULAR AND LENTICULAR-LIKE BEDDING IN THE PRECAMBRIAN TELEMAR SUITE, SOUTHERN NORWAY

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A thick succession with lenticular and lenticular-like bedding is described from the basal part of the Seljord quartzites of the Telemark suite. As a result of slumping, concretionary processes, and metamorphism this succession has been modified so that it gives a false impression of being a quartz conglomerate with flattened pebbles. A possible environment of deposition was one of a shallow sea in which tidal currents were active.

## INTRODUCTION

The 'Telemark Suite' represents a sequence of sediments, lavas, and tuffs. The sediments are mostly quartzites with interbedded conglomerates. Details of the stratigraphy have been discussed by Dons (1960a, b).

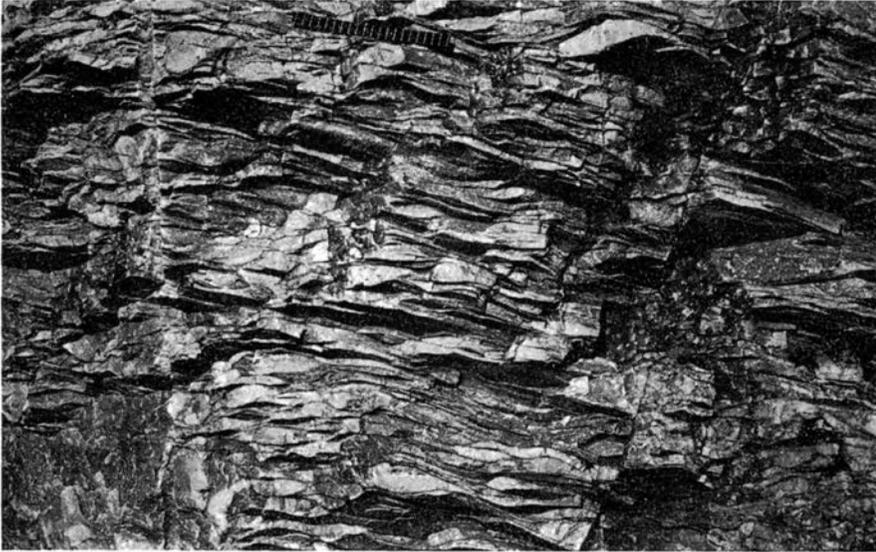
The depositional environment of the quartzites has been investigated, and a thick 'conglomerate' succession in the Seljord quartzites, exposed near Seljord, has been studied in detail. Dons (1960 b) describes this succession as a quartz pebble conglomerate which has suffered tectonic deformation, thus causing flattening and elongation of the pebbles. The object of this study was to examine the conglomerate to see whether it contains actual pebbles or whether it is a lenticular bedded unit which has suffered some deformation.

## OBSERVATIONS

The 'conglomerate' consists of elongated quartzitic lenticles, from biconvex to concavo-convex, or with related shapes. The quartzitic lenticles alternate with thin phyllitic layers and, at places, they grade into an almost parallel alternating quartzite/phyllite sequence (Figs. 1 and 2). A closer observation of these lenticles reveals, in some cases, well preserved foreset laminae (Figs. 3, 4 and 5). Whenever it is possible to observe the lenticles in two dimensions, they usually show thinning and thickening of the same quartzitic layer. The thickness of the 'conglomeratic' sequence is about 500 meters, which Dons (1960b) thinks is not the original thickness, but a result of thrusts or overfolding.

Some of the samples from this succession were studied in the laboratory, and slabs and thin sections were prepared. These were found to contain well preserved foreset laminae constituting a festoon type of cross-stratified units, which are commonly observed in lenticular bedding. The terms foreset bed and trough cross-bedding of Potter & Pettijohn (1963) are

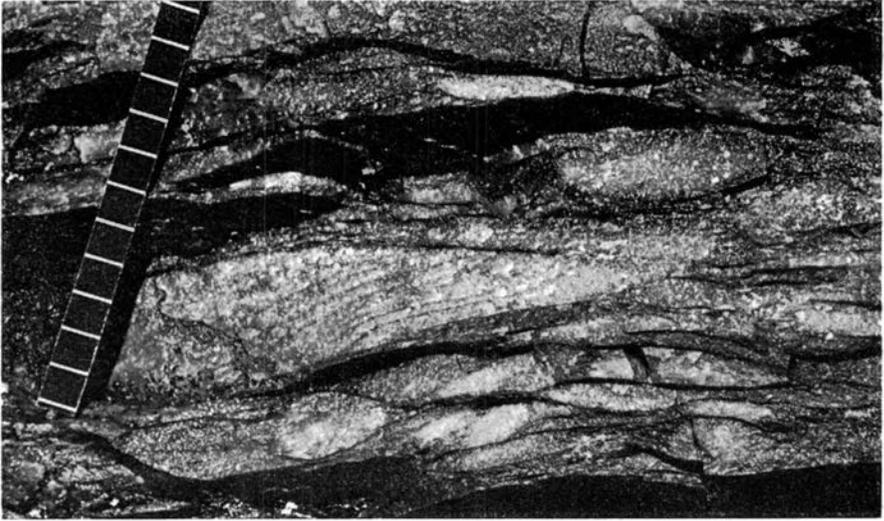
equivalent to foreset laminae and a festoon type of cross-stratification, respectively. Some of the pebble-like lenticular bodies with rounded ends are found to be the result, partly because of minor slumping along the clayey layers (now phyllitic layers), and partly owing to concretionary processes (especially iron precipitation). The foreset laminae in such cases continue across the concretionary bodies (Fig. 6).



*Fig. 1.* Lenticular bedding showing quartzite lenticles alternating with phyllitic layers. Note variation in the shape of lenticles. 1 division of the scale=1 cm.



*Fig. 2.* Lenticular bedding and parallel alternating quartzite/phyllite layers. Length of the hammer = 42 cm.



*Fig. 3.* Well preserved foreset laminae in one of the quartzite lenticles. Note in the lower part the development of pebble-like concretionary bodies within a quartzite lenticle. 1 division of the scale = 1 cm.

## ORIGIN

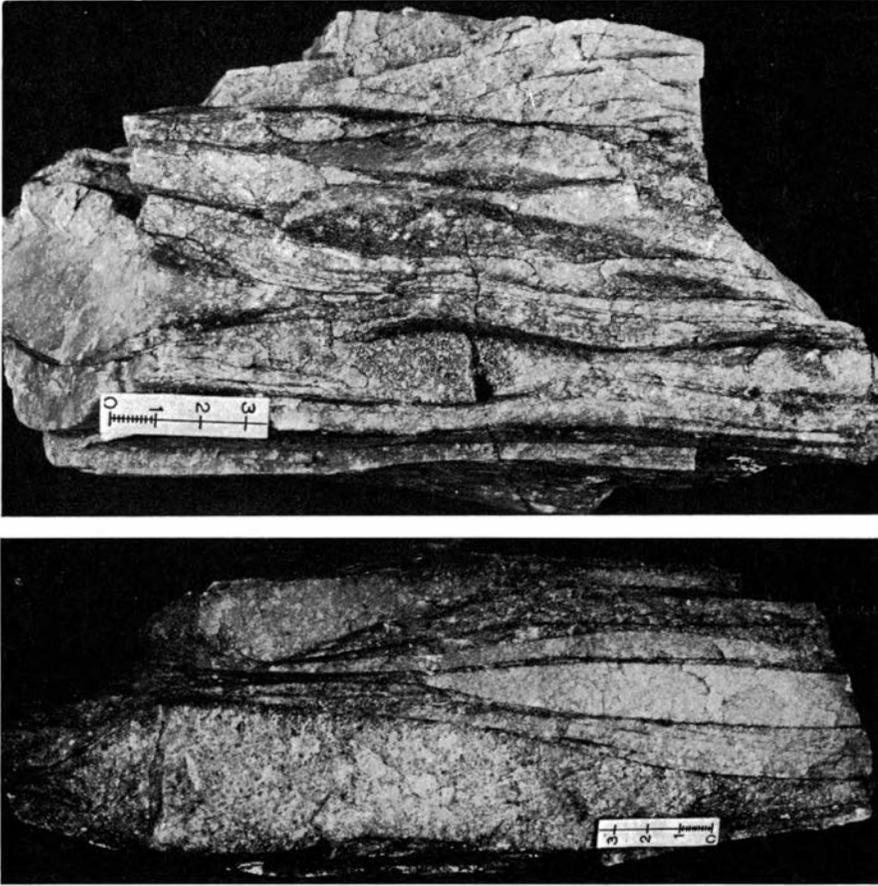
These observations suggest that the lenticles were originally not pebbles but were sand lenses. The whole succession, then, represents originally an alternating sand/clay sequence which now, after regional metamorphism, is a quartzite/phyllite succession. The sand was deposited due to ripple action, whereas the clay was deposited during quiescent periods (cf. Reineck 1960).

During diagenesis and regional metamorphism the shape of the sand lenses has been partly modified. At places, development of concretions with pebble-like features within individual quartzitic layers has taken place. Such changes make the recognition of primary structures difficult. Some of the bigger lenses are made up of several cross-stratified units. Fig. 7 shows the schematic arrangement of lenticular bedding in a block diagram.

## ENVIRONMENT OF DEPOSITION

Shallow sea and intertidal flats with tidal currents offer ideal conditions for the formation of lenticular bedding. Häntzschel (1936), van Straaten (1954) and Reineck (1960, 1963) have shown that these are at present being formed in shallow water and intertidal flat areas of the southern North Sea. Allen (1959) suggested that such structures are also found on delta front and delta flat environments. Coleman & Gagliano (1965) have described lenticular bedding in the Mississippi delta.

Other primary sedimentary structures recorded in the quartzites of the Telemark suite, e.g. ripple marks, cross bedding, flaser bedding, ripple lami-



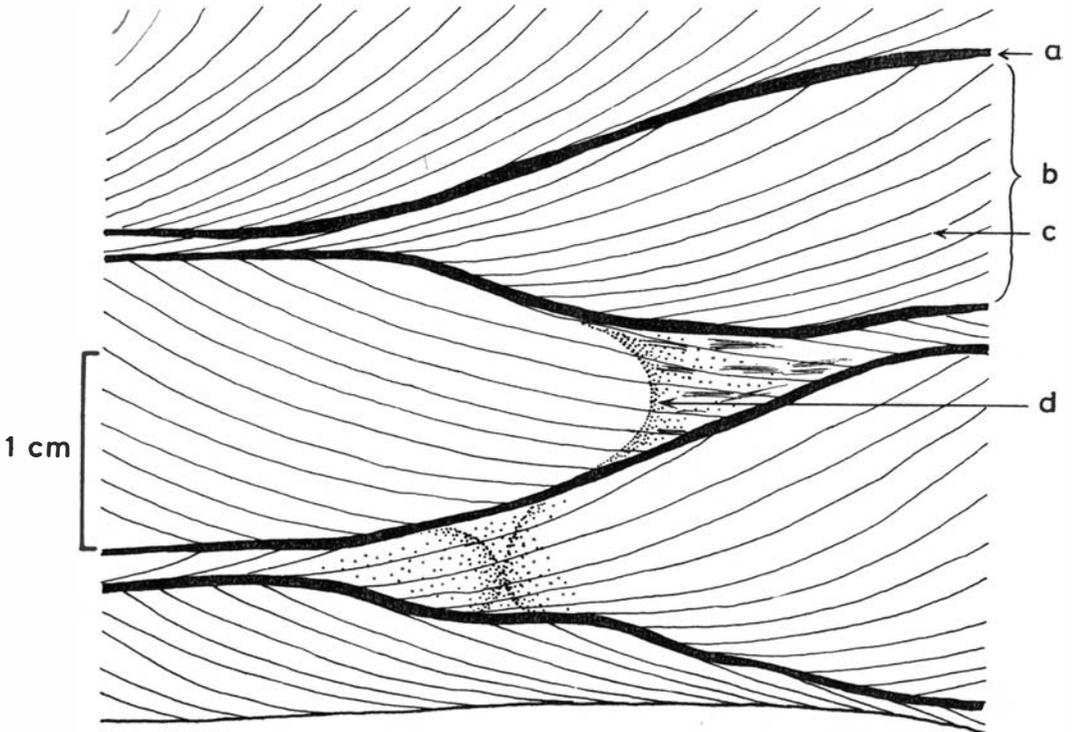
*Figs. 4 (above) and 5 (below).* Hand specimens showing lenticular bedding. Note the variety of shape and variation in thickness of lenses. Two quartzite lenses are always separated by a thin phyllitic layer. Scales in cm.

nation, wavy bedding, erosional channels, raindrop imprints, etc., suggest deposition by tidal currents in a shallow sea over intertidal flats. These features are to be discussed in detail elsewhere.

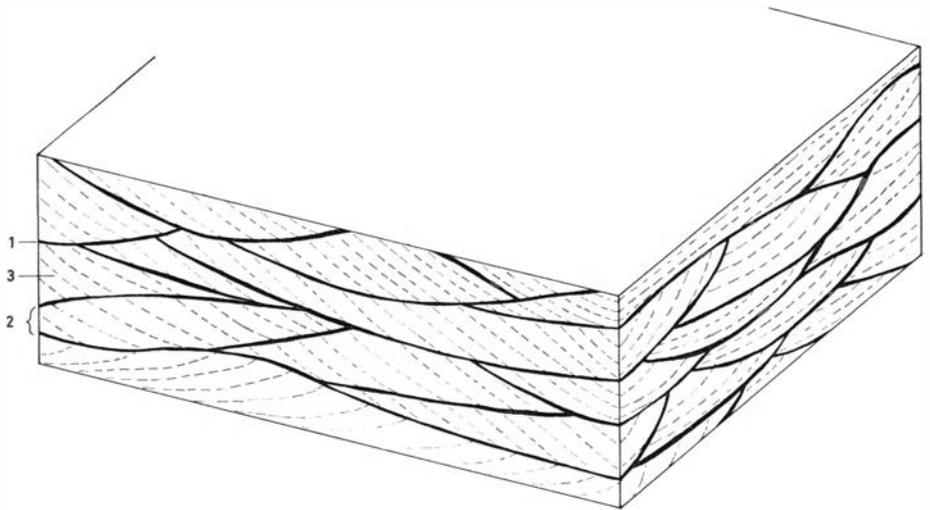
#### REMARKS

Apart from the above observations in the Seljord Quartzites, conglomerates of the Bandak Group also show the lenticular bedding-type features. However, at most places the Bandak Group also contains real pebbles.

The present study shows that lenticular bedding affected by slumping, concretionary processes and metamorphism, may often develop features similar to those of real conglomerates with flattened pebbles. It is the view of the author that the so-called 'conglomerates with flattened quartz pebbles' need careful examination.



*Fig. 6.* A sketch drawn from a thin-section shows the continuity of foreset laminae across the rounded ends of the pebble-like bodies. a=phyllitic layer; b=quartzite lenticle; c=foreset laminae; d=iron oxide concentration.



*Fig. 7.* Schematic block diagram showing arrangement of quartzite lenticles (sand lenses) and phyllitic layers (clayey layers) in two dimensions. 1=phyllitic layer; 2=quartzite lenticle; 3=foreset laminae.

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