

PROVENANCE STUDIES ON DETRITAL GARNET FROM PALEOCENE AND EARLY EOCENE DEPOSITS

by

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Varietal studies are more suitable for provenance determinations than traditional heavy mineral counting, since the effects of possible error sources (intrastratal solution, hydraulic differentiation) are ruled out.

Garnet has been shown an interesting mineral for these purposes because of its chemical variability and its wide distribution in detrital sediments (Morton, 1985, 1987; Van der Sluys, 1990).

Garnet grains from 20 samples of Paleocene and Early Eocene deposits from Belgium and SE-England have been selected and examined using an electron microprobe. In each sample, 20-25 grains have been analysed (if possible), and special interest has been paid to the crucial ratio FeO/MnO/CaO/MgO, which is characteristic for the pyrope+grossular-series (only Al-rich garnet has been found). These results have been presented in ternary plots (fig. 1), allowing recognition of 5 different garnet varieties (fig. 2): almandine (**alm**), grossular-almandine (**gr-alm**), pyrope-almandine (**py-alm**), spessartine (**sp**) and a Ca-Mg-bearing Mn-rich almandine («mixed type», **mix**)

Garnet associations in the Hannut Formation (Paleocene, «Lower Landenian») from Hesbaye (East-Belgium) are completely different from those in the rest of the country. In the Hesbaye unit (Lincent Member), all garnet belongs to the spessartine-variety (**sp**). This association is identical to that found in Cretaceous deposits and in the Heers Formation (Van der Sluys, 1990).

More to the north, in the Halen Member, as well as in the western part of the country (Chercq Member) the spessartine association is replaced by the more typical alm + gr-alm association. Minor proportions of other garnet varieties (**py-alm**, **sp**, **mix**) are also present. In the upper unit of the Hannut Formation (Grandglise Member), the same association continues, although the

sp-content seems to decrease. Unfortunately, this member does not contain garnet in the Hesbaye region.

The continental-lagoonal Tienen Formation («Upper Landenian») virtually contains no garnet, except in the Knokke Member of NW-Belgium, where the same alm + gr-alm association occurs. The alm-content increases.

The early Eocene Kortrijk and Tielt Formations (Ypresian), generally contain the same garnet association, although **sp** and **py-alm** seem to be much less frequent. Furthermore, the Kortrijk Formation contains much more gr-alm than the more sandy Tielt Formation.

The garnet associations resemble similar associations from Thanet Formation, Reading Bottom Bed and London Clay Formation in SE-England (Van der Sluys, 1990, 1991), as well as garnet associations from the Forties Formation of the Central North Sea (Morton, 1987). In these associations, gr-alm dominates over alm and other varieties, except for the Reading Bottom Bed, where more alm occurs. Another striking feature is the relative abundance of **py-alm** in the London Clay Formation (not occurring in the equivalent Kortrijk Formation).

In general, the provenance of garnet in the Belgian and English Paleocene and Lower Eocene is similar. Comparison with source rocks indicates that the typical alm+gr-alm association is derived from Scottish Caledonides (Grampians). Higher amounts of alm probably indicate an influx of detritus from South Scandinavia (Precambrian). The origin of **py-alm** is probably Scottish as well, since its content seems to decrease in the eastern part of the Belgian basin.

The small amounts of spessartine are derived from the Brabant Massif, the «mixed garnet» has probably originated from the Ardenne metamorphic region. In the Lincent Member (Hesbaye), the Brabant Massif

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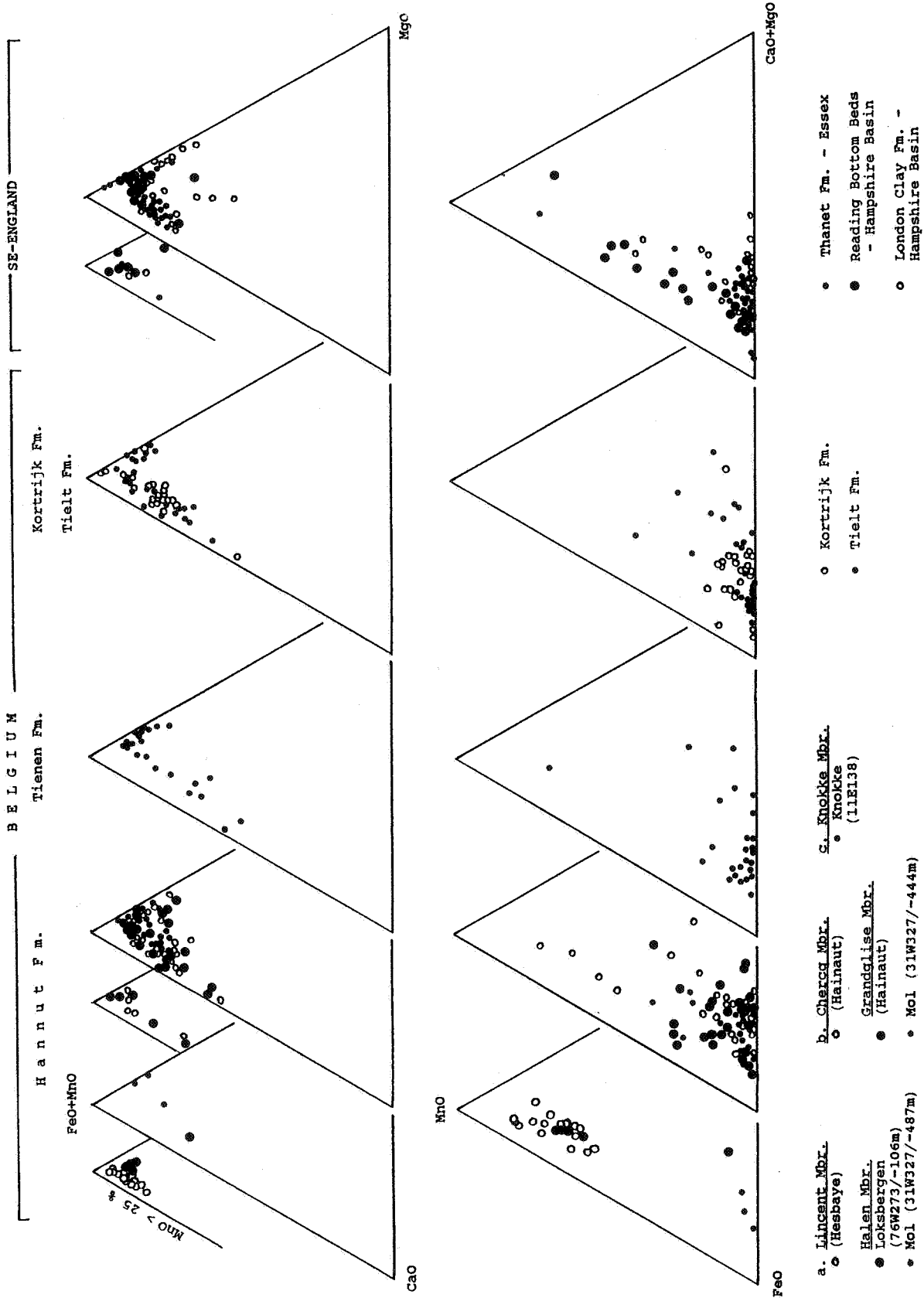


Figure 1. Detrital garnet compositions of Belgian and SE-English Paleocene and Lower Eocene deposits.

seems to have been the exclusive detrital source, considering the absence of any other garnet variety.

We can conclude that the Paleocene-Eocene boundary does not represent a marked break in directions of sediment supply in the southern part of the North Sea Basin. Most of this supply is from Scottish metamorphic rocks, and, notably in Belgium, to a lesser extent from South Scandinavia. The Brabant Massif locally supplied detrital material during deposition of the Hannut Formation in Hesbaye.

However, a more detailed determination of the source regions still requests a better knowledge of garnet chemistry and abundance in these regions.

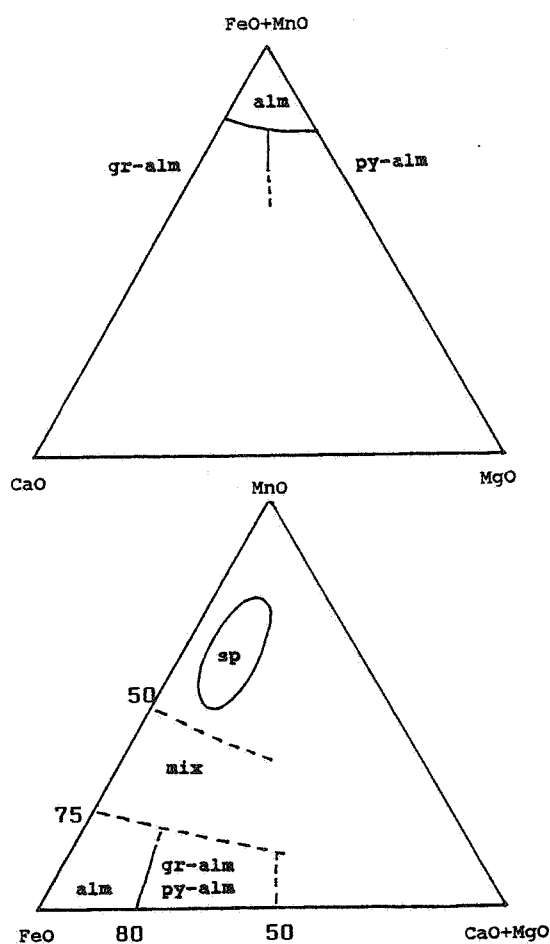


Figure 2. Detrital garnet varieties.

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