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MORPHOGENETIC EVOLUTION OF THE RIVER SYSTEM OF SOUTHERN PIEDMONT (Italy)

RIASSUNTO: BIANCOTTI A. & CORTEMIGLIA G. C., *Evoluzione morfogenetica del reticolo idrografico del Piemonte meridionale (Italia)* (IT ISSN 0084-8948, 1982). Viene segnalata la presenza nel Piemonte meridionale (Italia) di un esteso reticolo idrografico, oggi abbandonato, ma ancora attivo alla fine del Pleistocene.

L'attuale reticolo idrografico si presenta fortemente divergente rispetto a tali tracce pleistoceniche, in quanto risulta nettamente più spostato verso NE. L'età in cui si verificò tale mutamento dei deflussi si stima venga a porsi in un intervallo piuttosto breve, da collocarsi fra la fine del Pleistocene superiore e 4 380 ± 70 anni B.P. L'ipotesi più probabile a cui correlare tale spostamento verso NE del reticolo idrografico sembra quella di un basculaggio di tutta l'area del Piemonte meridionale dovuto ad un innalzamento della zona occidentale e ad un abbassamento di quella orientale.

RÉSUMÉ: BIANCOTTI A. & CORTEMIGLIA G. C., *Évolution morphogénétique du réseau hydrographique du Piémont méridional (Italie)*. (IT ISSN 0084-8948, 1982). Les auteurs signalent la présence dans le Piémont méridional d'un étendu réseau hydrographique désormais abandonné, mais encore actif à la fin du Pleistocène.

Le réseau actuelment actif montre une nette divergence vers NE à l'égard de ces traces pleistocènes. L'âge de cette divergence se vérifiait entre la fin du Pleistocène superieur et 4 380 ± 70 ans B.P. L'hypothèse, la plus probable, pour expliquer cette divergence vers NE du réseau actuel, c'est celle d'un phénomène de basculage de l'entier Piémont meridional du à l'abaissement de la zone orientale et au soulèvement de celle occidentale.

Краткое содержание: Бианкотти А. & Кортемилья Г. К., *Морфогенетическая эволюция гидрографической сетки южного Пьемонта* (Италия).

(IT ISSN 0084-8948, 1982). В южной части Пьемонта отмечено наличие обширной гидрографической сетки, заброшенной в настоящее время, но которая действовала до конца четвертичного периода.

Существующая гидрографическая сетка значительно отличается от сетки эпохи четвертичного периода (плейстоцен), поскольку четко наблюдается ее сдвиг на северо-восток. Период этого сдвига падает на промежуток между концом верхнего плейстоцена и 4380 ± 70 годами Б. П.

Наиболее вероятной гипотезой такого смещения являются колебания земной коры всей южной части Пьемонта, вызванные поднятием западной зоны и опусканием восточной.

TERMINI-CHIAVE: cattura; ciclo d'erosione; ringiovanimento geomorfologico.

Southern Piedmont lies within the Western Alps, it consists of three large physiographic units: the "Plain of Alessandria" to the SE, the "Plain of Cuneo" to the SW, with the "Langhe hills" between them.

The Langhe hills belong to the so-called "Tertiary Basin of Piedmont". The complete Oligocene to Pliocene series crops out. Its monocline structure has a SW-NE axis, and its dip is towards the NW.

The Alessandria Plain and Cuneo Plain are composed of Quaternary river sediments overlying Tertiary bedrock. Their surface is irregular. The Quaternary sequence is mostly Pleistocene, the Holocene part being diminutive in both bulk and thickness.

The whole of S Piedmont is now drained by the Po River. In the Alessandria Plain the direction of the terminal stretch of the rivers is NE for the westernmost rivers (Bormida, Belbo and Tanaro), N for the easternmost (Scrivia and Orba).

This drainage pattern is everywhere accompanied by sporadic traces of abandoned valley furrows and water gaps of the rivers. These and other clear evidences of change, show that the previous pattern was very different.

There are four main evidences of the existence of this earlier pattern:

1 - In the western section of the Cuneo Plain, S of Turin, an abandoned SE-NW river bed reveals the direction in which the Tanaro River once flowed into the Po. This bed was abandoned by the Tanaro when it was deviated to enter the Po near Isola S. Antonio (Alessandria). Various reasons for this NE deviation have been proposed: diversion, capture, moraines. It is generally agreed that the ancient bed was probably still active at the end of the Pleistocene (SACCO, 1917; 1942; CASTIGLIONI, 1934; PEOLA, 1942; CARRARO, 1976; 1981; BIANCOTTI, 1979).

2 - In the SW part of the Langhe hills, the drainage pattern of the so-called "Palaeobelbo", running SE-NW along the line "Alto Belbo-Passo della Bossola-Rea", was

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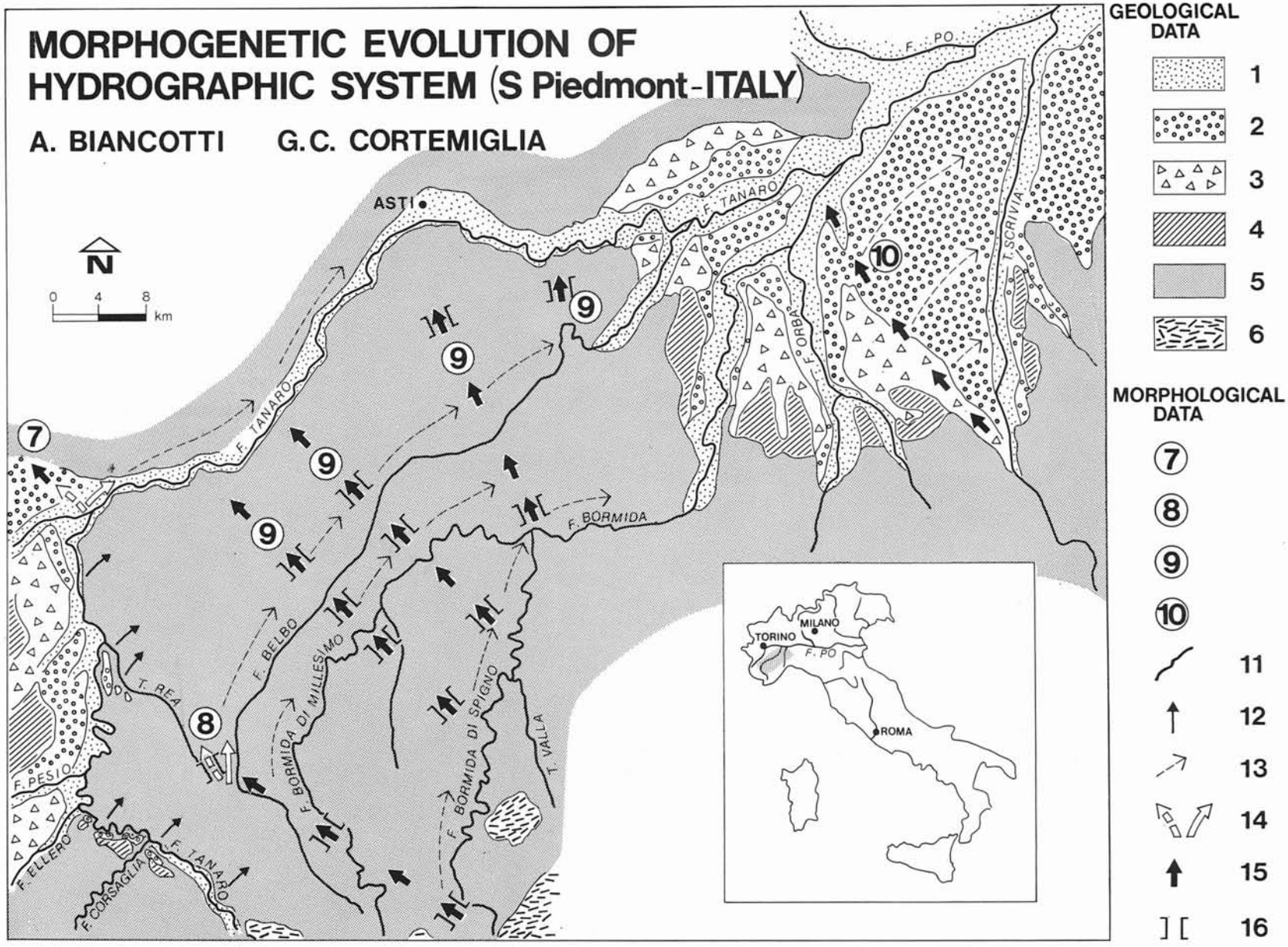

FIG. 1 - Explanation. Geological data: 1) Holocene; 2) late Pleistocene; 3) middle-late Pleistocene; 4) middle and middle-lower Pleistocene; 5) Tertiary; 6) Pretertiary. Morphological data: 7) palaeovalley of Tanaro River; 8) palaeovalley of Belbo River; 9) palaeovalley of Bormidas rivers; 10) palaeovalley of Scrivia River; 11) present-day talwegs; 12) present-day erosional trends; 13) directional diversions of downflows (late Pleistocene); 14) captures (late Pleistocene); 15) direction of Pleistocene downflows; 16) fluviatile erosion saddles.

relinquished by the Belbo due to capture in the late Pleistocene (BIANCOTTI, 1981).

3 - A whole series of saddle-shaped furrows, clearly of fluvial origin (BIANCOTTI, 1981) can be seen in the central Langhe hills, where the watersheds dip slightly NNW, owing to their dependence upon an ancient Villafranchian glacis (GABERT, 1962). Their alignment varies from SSE-NNW to SE-NW as one moves eastwards, and crosses the present watersheds nearly at right-angles and at the same height. Here fluvial erosion terraces have been found ("first-order terraces" according to BIANCOTTI, 1981), along with Pleistocene alluvial deposits (GABERT, 1962; CARRARO, 1981), which means that the abandoned sections also belong to this epoch.

4 - The surface morphology of the Alessandria Plain (CORTEMIGLIA, 1980; 1981), and Engineering Geology surveys of the deep alluvial deposits (BRAGA & CASNEDI, 1976), demonstrate the existence of a Pleistocene abandoned channel of the Scrivia River on the alignment Serravalle Scrivia-Pozzolo Formigaro, which led into the Po at Alessandria. The present N-S terminal section of the Scrivia flows far to the E, near Cornale. It was formed between the end of the Pleistocene and 4 380±70 B.P. (CORTEMIGLIA, 1981).

Taken as a whole, the data indicate that these stream channels must have still been active in the late Pleistocene.

Fig. 1 shows a simplified outline of southern Piedmont. It is clear from the arrangement of the talwegs that the late Pleistocene drainage pattern was radically different.

The geological evolution of some deposits from these areas offers further evidence in support of the morphological picture.

In the Alessandria Plain SW of Pozzolo Formigaro, a paleosol was formed during the Riss-Würm Interglacial upon a "Middle Fluvial" Riss deposit (CORTEMIGLIA, 1981). It was then eroded and truncated down to C horizon, and covered by Würm loess (BIANCOTTI & CORTEMIGLIA, 1981).

This means that the NE deviation of the main channel of the Scrivia, which caused it to turn about 45° on its fan at the valley mouth, can only have taken place after the beginning of the late Pleistocene.

Examination of the paleosols on the river terraces of the Tanaro has led BIANCOTTI (1979) to attribute previous orientation of Bormida di Millesimo, Bormida di Spigno and Tanaro Valleys to the late Pleistocene.

A further morphological clue can be seen in all the more important southern Piedmont rivers. The Pleistocene terraces are well developed on the orographic left side of their valleys, but absent or nearly so on the right. This is clearly apparent in the middle Tanaro Valley, the lower Valle Rea, and in the valley mouths of the Orba and Scrivia, while the two Bormida have no terraces.

This asymmetry can be substantially referred to intensive erosion of the base of the right bank, and partial or total destruction of its outcrops.

Together with this shift, itself in a NE direction, verticalisation of the right banks with respect to those on the left is often observed in places where the nature of the terrain permits.

Landslides due to erosion of the base of these banks are common, suggesting that displacement of these rivers may still be going on.

Further support for this view is offered by CARRARO's (1981) attribution of a late Pleistocene or even Holocene age to flow rate fluctuations of the Tanaro on neotectonic grounds.

The data therefore seem to show that the Pleistocene drainage pattern was very different from the present one, since its main rivers flowed into the Po through mainly NW oriented valleys, as illustred in fig. 1.

Relinquishment of this network due to a NE shift of the talwegs brought the rivers of the W sector into the Po in the Alessandria Plain, and reduced the height of their outlets by 100-150 m. According to BIANCOTTI (1981), this intensive regressive erosion exerted considerable influence upon the development of the landscape of the Langhe hills.

CONCLUSIONS

The morphological data for southern Piedmont allows to outline of a SE-NW Pleistocene drainage pattern that has now been abandoned. The present rivers are NNE oriented, i.e. the network is clearly bent eastwards, and the main rivers have shifted their confluence with the Po.

This shift is greater in the western area (Tanaro) than to the East (Scrivia). It took place between the beginning of the Würm and 4 380±70 years B.P., and may still be partially active, though on a very reduced scale.

The phenomenon is probably the result of brief, intensive morphotectonic action, since there are no traces of a gradual eastward shift of the network. This would have been evident in the plain.

The most plausible hypothesis is that of tilting of the whole southern Piedmont area, with lowering of the eastern section and an uplifting of the western section, between the end of the late Pleistocene and the beginning of the Holocene.

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