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Origin and sources of the neolithic raw materials in Croatia

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In studying the Neolithic of Croatia one should keep in mind that its territory is characterized by variety of composition: 1. about 1/3 of Croatia is of a striking plain character surrounded and interrupted by a belt of small hills and hills which separate them from the mountainous regions of the Alps in the west and Dinarides in the south-west; 2. the Dinarides are characterized by chain mountains of steep slopes with karst phenomena and deeply incised river valleys; 3. all stream waters belong to the catchment areas of the Black Sea (79 %) and Adriatic Sea (21 %), but the density of the river net is the smallest in karst regions. The stream waters in mountainous regions are of the greatest fall and energy, especially upper and middle parts of their catchment areas. Closely to the Pannonian basin, the falls suddenly decrease and rivers assume appearance of plain rivers.

Also, to understand the reasons of Neolithic raw material exploatation, the geology of Croatia must be considered in the context of wider area which is, thanks to its position in European part of the Alpine orogen, i.e. Mesozoic carbonate platform, characterized by a complicated geological composition. Paleogeographically and geotectonically, this area can be divided into two main parts: the External Dinarides (Adriaticum, Epiadriaticum and Dinaricum) composed of Mesozoic limestones and dolomites and the Internal Dinarides (Supradinaricum) consisting mainly of Mesozoic ophiolites and formations of the Tethyan active and continental margins (Herak 1986, Drobne & Trutin 1997). Its earliest evolutionary phases during the Alpine cycle were probably related to rifting processes which started in the Late Permian/Early Triassic (Pamić 1984).

Because Late Permian and Triassic magmatism produced basalts, andesites and dacites in extrusive level, and gabbro, diorite, granosyenite and granite in intrusive level, and because of the great diversity within the Dinarides (Jurkovic and Pamic 1999) the following magmatic groups are defined by different rock types (Fig. 1):

I - the dacite-quartz keratophyre (with subordinate andesite and basalt) magmatic group of Slovenia mainly included within the Sava nappe,

II - the basalt-spilite-andesite magmatic group of Gorski Kotar, Lika and Dalmatia,

III - the basalt-spilite magmatic group of Hrvatsko Zagorje and SE Slovenia: small group composed of basalts, largely transformed into spilites with some andesites associated with pyroclastic rocks,

IV - the basalt-spilite-andesite-keratophyre-quartz keratophyre magmatic group associated with gabbro, diorite and granosyenite of SW Middle Dinarides. The volcanics are accompanied by larger plutonic bodies in some places in association with numerous swarms of diabases. Middle Triassic volcanic-sedimentary formation is in this area represented with tuff, tuffite, tuffitic sandstone, iron-manganese schist, shale, chert, and volcanic rocks,

V - the andesite-keratophyre-quartz keratophyre magmatic group with subordinate diorite and granosyenite of SE Bosnia and N Montenegro,

VI - the basalt-spilite magmatic group of SE and Central Bosnia.

At the same time, metamorphic rocks of this area (Central Dinaride Ophiolite Belt = CDOB) are represented by low-grade metamorphism, or by lower part of greenschist facies and by higher or high-pressure metamorphism: phyllites, chloritoid schists, chlorite schists, greenschists, calcschists, metapsamites, quartz micaschists, eclogites etc (Majer et al. 1993). The ophiolite belt contains also the greatest masses of spinel lherzolites known by now in the world (Garašić & Majer, 1993), while alkali amphibole bearing metamorphic rocks (blueschists) are mostly encountered in the collision area between Dinarides and bordered geotectonic units of the Pannonian basin, and only a few occurences are connected with the ophiolite belt (Majer & Lugović 1991).

Thus, because among neolithic tools found at Croatian sites most common are diabases, gabbros, amphibolites, quarz, quarzite, chert, etc., sporadically nephrite, obsidian, jasper, jadeite and opal (Benac 1979), with exception of obsidian (origin: ?Italy) and jadeite (origin: ?Italy or ?Macedonia), the raw materials are autochtonous and not imported. Namely, regarding the mentioned geological and geographical but also archaeological characteristics of the area, the sources of raw materials in Croatia are prevailingly formations which occur as raised eroded cores of megastructures represented by high christalline schists (two-mica gneisses, amphibolites and micaschists) encountered below a thick cover of the Tertiary and Quaternary sediments in Pannonian basin as well as the magmatic group of Hrvatsko Zagorje. Also the raw materials are brought by water courses rich in pebbles and rocks (Soča, Sava, Drava, Una, Bosna, Neretva etc.) directly from outcorps of volcanic and metamorphic rocks partly of Slovenia and partly of Bosnia, or maybe Serbia and Montenegro. Namely, the main

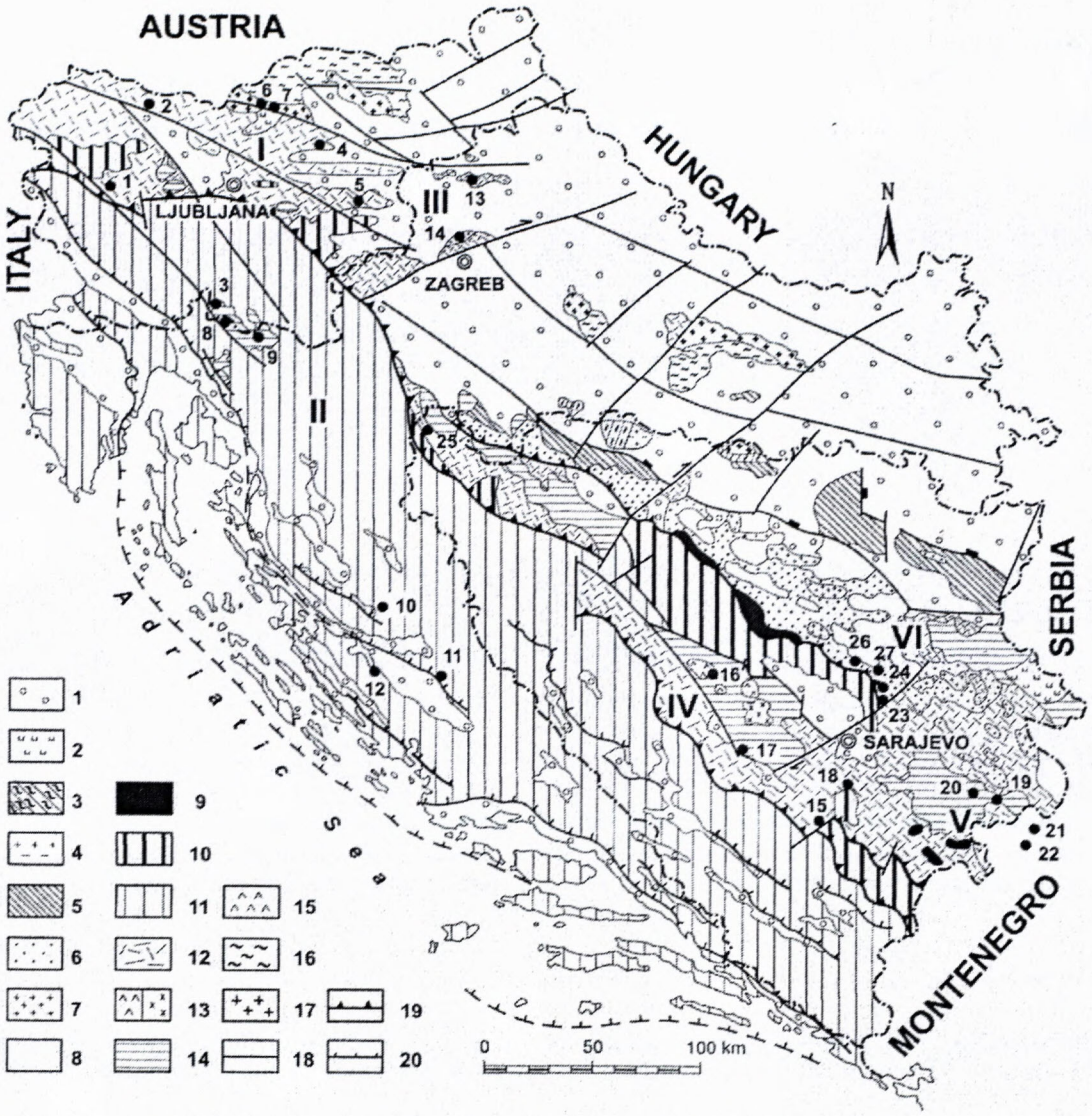

Fig. 1 Compiled sketch map of the northwestern and central Dinarides showing position of main Alpine mineral deposits (I. Jurković, J. Pamić 1999)

*Legend: 1 Tertiary and Quaternary sediments; 2 Tertiary volcanics; 3 Paleogene metamorphic rocks; 4 Paleogene granitoids; 5 Upper Cretaceous-Paleogene flysch; 6 Dinaric Ophiolite zone, mostly melange; 7 Lowe to Upper Cretaceous sequences uncoformably overlying ophiolites; 8 Larger ultramafic massifs; 9 radiolarites; 10 Jurassic to Upper Cretaceous sequences of the passive massifs; 11 Adriatic-Dinaridic carbonate platform; 12 allochthonous Triassic sequences small paleozoic masses; 13 larger bodies of Triassic volcanic (a) and plutonic (b) rocks; 14 allochthonous Paleozoic sequences; 15 larger bodies of Paleozoic volcanics; 16 Paleozoic metamorphic rocks of the Eastern Alps and Tisia; 17 Paleozoic granitoids and migmatites; 18 strike-slip fault; 19 interterrane thrust; 20 interterrane thrust; **I – VI** magmatic-metallogenic subprovinces.*

characteristic of the neolithic settlements in Croatia is its position along the interfluvial regions on elevated river banks or on natural rises near streams, small rivers and marshes. Thus, depending on all natural sources, the neolithic population in each specific region used the raw material found in vicinity of the settlement without long distance search. At the same time, the tools made from the rare raw materials, such as obsidian or jadeite, probably represent luxury items or presents occasionally imported in limited quantity along the trading or migrating routes.

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