

THE INFORMATIVE VALUE OF TOPONYMS. THE CASE OF THE WORD *BERROCAL* AND ITS VARIANTS

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I. INTRODUCTION

It has been customary in geographical analysis to resort to toponyms as elements that can provide important, albeit preliminary, information about an area of study; at the least they afford clues that can later be corroborated by means of tasks that demand another kind of approach. Toponyms often used to be considered as having practically undisputed value as indicators, something which does not seem consistent with the nature of place names, which for different reasons do not always have the precision they have often been imbued with.

This work therefore makes an attempt to verify to what extent the names used to designate villages, districts, mountains, plains, streams and farms possess this value as effective indicators of certain characteristics of the environment or of other circumstances. To do so we have chosen a family of toponyms: those related to the noun *berrocal*, an appellative that refers to a lithological and morphological combination that in principle is not very equivocal and which is used to designate a landscape of variable size characterized by the presence of spherically weathered granite boulders in more or less chaotic formations.

In short, the starting hypothesis is to consider whether this family of toponyms faithfully reflects, within reason, the lithological, morphological or landscape situation just described.

II. DATA EMPLOYED AND PROCEDURE FOLLOWED

Perhaps the most problematic task that arises when approaching a project such as this consists of choosing the list of toponyms that can be used, above all if we are considering the entire territory of Spain. It was a matter of obtaining a set based on some kind of standardized procedure in order to avoid the possible biases inherent in a collection of data carried out without criteria, which furthermore would constitute an impossible amount of work in terms

of time available. We thus decided to use the Database of Geo-referenced Toponyms from the Spanish National Centre for Geographic Information (*Base de datos de topónimos geo-referenciados* del Centro Nacional de Información Geográfica [CNIG]).

The second issue that had to be resolved was choosing the search criteria for the database. This choice had to take into account the toponyms that included a word from the same family or linguistic root (including allomorphs) as the words *berrocal* or *berrueco*.

In this way we obtained 275 entries from the database. All of them are geo-referenced with three types of coordinates: on the one hand with the UTM ED-50 projection, in each of the three possible zones of the Iberian Peninsula, and on the other hand in latitude and longitude in both decimal and sexagesimal degrees. Each toponym (or better said, each record) corresponds to a pair of coordinates, that is, it is represented by a point, which obviously involves a noteworthy simplification in the cases of those toponyms that refer to linear entities or entities that can occupy a more or less large area.

Of these 275 entries, we rejected those that had an exact duplicate in the geo-reference coordinates, maintaining in all cases the most significant or highest ranking toponym. After this refining, the number of entries was reduced to 212.

Examination of the typology of toponyms yielded that practically half of them refer to an orographic elevation, such that as we already mentioned, this family of place names has frequently been used to designate topographical unevenness; however, the number of towns or places in which these denominations are used is also considerable.

The next step was to convert this database with 212 entries into a point map. The result is shown in Figure 1. This first map is already quite significant, if only for the most common distribution of the toponyms, with a nucleus clearly located along the Central Mountain Range and a less dense western strip. We have tried to determine whether this pattern is due to chance or, as it seems to be visually, whether the location of the toponyms is not random. Different analyses of specific patterns, spatial structure and density were also carried out.

To do so, we ran the *nearest neighbour test*, using as the area of reference the whole of peninsular Spain (493.716 km²). Calculations were made on the first, second and third nearest neighbours. To support the results of this test, which measures whether a distribution is random, well-spaced, or shows a trend towards concentration, we also ran the Kolmogórov-Smirnov test, dividing the peninsular territory into 516 hexagonal cells measuring 1.000 km², and we obtained the index based on these cells (see Figure 2).

We also determined the basic spatial statistics of centrality and dispersion, that is, the mean centre, the geometric mean centre, the harmonic mean centre, the median centre, the minimum distance centre, the standard distance, the ellipse of the standard deviation and the standard deviation of the *x* and *y* coordinates. All of these values were calculated using CrimeStat III.

To strengthen this type of analysis linked to the spatial distribution, we also calculated focal densities, which in short is a matter of establishing the areas in which theoretically we would be more likely to find a toponym of the *berrocal* family, based on the different groups of entries identified. To draw up this map of focal density we also used the CrimeStat III programme.

To approach what is probably the fundamental aspect analysed in these pages, that is, the degree of correspondence between the location of the toponyms of the *berrocal* family and the lithology of these places, we used the Geological Map of Spain with a scale of 1/1.000.000 in digital format made by the Geological and Mining Institute of Spain (IGME) in 1994.

In order to find out on which formations the 212 points established lie, we carried out what is known as a spatial link or point-in-polygon analysis. Using this link we transferred to each of the toponyms the attributes of the database of the polygons that contain those points and that represent geological cartographic units.

In some cases, the points that represent the toponyms are located on water (reservoirs); in other cases, the toponyms are located on unexpected geological units. In both cases we first established whether the toponym could be dubious, and in all cases we estimated the shortest distance from that point to the border of the closest polygon containing a geological unit plausible for the effects considered in our study. If it was a dubious toponym and the distance to the closest admissible lithological formation was greater than a league (5572.7 metres), we assumed that it was an erroneous case and eliminated that entry from our final analyses. We typified the rest of the situations as toponyms that are not good indicators. The reason we established a league as the distance was because it clearly surpasses the positional error that we can attribute to the maps used.

Once the spatial link was made, the point map then included in its table of attributes the complete lithological description of the polygons containing these points. There were 32 units (including surfaces covered by water) on the 96 formations described on the geological map of the Iberian Peninsula and the Balearic Islands. Of these 32 units we concluded that only 6 would be admissible in principle as lithologies on which the type of morphology in question could appear, and these are as follows: a) *migmatitic-anatectonic complexes*, b) *alkaline granitoids (extensional frame)*, c) *biotite granitoids*, d) *two-mica granitoids*, e) *peraluminous granitoids (collisional frame)* and f) *undifferentiated s.l. granitoids*.

This decision enabled us to create a new point map from which we excluded all the toponyms that were located on any of these six formations, that is, 90 of the 212 original entries. Thus, 122 toponyms (57.5%) are located on potentially suitable lithologies. The following step consisted of calculating the distance in a straight line between each one of these 90 points and the closest border of a lithological unit able to give rise to a morphology of *berrucos* (see Figure 3); the following morphologies had to be added to the six classes mentioned above: a) *calc-alkaline granitoids*, b) *granitoids with a postcinematic alkaline tendency* c) *metagranites*, d) *ultrabasic rocks (serpentinites, Active margin)*, e) *intermediate and basic rocks*, f) *basic and ultrabasic rocks*, g) *undifferentiated acid and basic complexes* and h) *acid-basic alkaline complexes*. To do this we used the *Nearest features* extension which generates a table in which in this case each point is assigned the closest lithological unit from among those selected and also the distance is established between the points and these formations.

Of the 90 entries that were rejected in principle, 36 are found at less than a league from the 14 lithological sets. There would thus be 158 entries for which we can assume that there exists a reasonable connection between the meaning of the toponym and the lithological characteristics of the surrounding environment. We then had to inquire as to whether the

toponyms of the remaining 54 entries have some kind of ambiguity that would mean ruling them out.

The idea was that a false attribution of these toponyms to the *berrocal/berrueco* family should not contribute to increasing the number of entries that act as false predictors of a granite boulder landscape. To resolve this we calculated that 10 of the 26 entries should be ruled out, the proportion of entries ruled out being greater within the subset of toponyms that are not found on granite terrains than otherwise. Figure 4 shows the final distribution of the two sets of data considered, in the one case composed of 154 entries and in the other of 48.

Finally, the last step consisted of verifying whether in the proximity of the 154 entries that we finally selected there existed a landscape of *berrocales*. To test this we carried out a photo interpretation of the surrounding area where each toponym was located using the images offered by the SigPac viewer.

III. THE TOPONYM *BERROCAL* AS AN INDICATOR OF GRANITE BOULDERS

The visual impression that the toponyms in question have a concentrated distribution pattern was confirmed with the different statistical analyses that were run. Indeed, according to the nearest neighbour technique the likelihood that this concentrated structure is random is less than 1%, with neighbour R values of 0.33, 0.38 and 0.45, respectively, for the first, second and third nearest neighbour, and that was taking into consideration the 212 original entries and the entire peninsular territory. We arrived at the same conclusion with the Kolmogórov-Smirnov test: the **D** index takes a value of 0.19, likewise allowing us to affirm that the distribution of the toponyms is not random.

This conclusion may seem obvious, in the sense that it is normal for a place name that refers to lithologies that make up 8.8% of the peninsular surface to appear mainly in relation to these surfaces. It is more important to verify that if we only consider the 158 entries for which in principle we assumed there was a reasonable connection between the toponym and the lithology of the surrounding area and also the area of distribution of the different units of granitoids (43475.62 Km²), we again find by means of the nearest neighbour test a result of concentrated structure, and the probability that this pattern is due to chance is likewise less than 1%. That is, the toponym *berrocal/berrueco* is not used with the same regularity in the different granitic areas and thus it seems to have a local component.

The distribution measures reinforce this impression. The different statistics of centrality (with the exception of the harmonic mean centre) are located in the province of Avila, around the mountains in Piedrahita and Villafranca, and the typical distance is 136.15 Km, with a poorly marked standard deviation ellipse and thus one very similar to the circle defined by the radius of the standard distance. Seventy-four percent of the 158 toponyms enter this circle and the standard deviation ellipse and 91.8% enter the second standard deviation ellipse. It is therefore a considerably compact distribution, or at least one with a very dense nucleus along the Central Mountain Range between the provinces of Madrid and Ávila.

This can be observed very clearly with density maps. We generated two maps: one for the 212 original entries and another for the subset of 158 toponyms dealt with subsequently. The two focal points with the highest densities can be clearly observed on both maps (Figures 5 and 6), and then others of less density that furthermore are not continuous with the Avila-

Madrid sector, especially in Figure 7, where the elimination of 54 toponyms makes the locations we could consider furthest from the centre disappear.

It is also quite evident that it is a clearly occidental phenomenon corresponding exactly to the main location of rock of igneous origin. Once again we observe the spatial concentration of this denomination of the granite outlayer along the Central Mountain Range and the bordering areas and at the same time, its relative absence from Galicia, where we find very large cultivated land sectors over appropriate lithologies, but where the word *penedo* is much more frequent as the toponym referring to these granite or other types of rocky places.

As we mentioned earlier, of the 212 original entries, 202 are unequivocal from the linguistic point of view and of these 202, there are 48 that are not on a granite geological formation or located at less than 6.6 Km from the border of one of these formations. In other words, 23.76% of the toponyms of the *berrocal* family incorrectly predict the type of geological substrate to be expected. In Table 3 we present a summary of the lithological formations to which we can ascribe 48 toponyms. Although they are units that occasionally comprise rocks that can give rise to contrasted morphologies, it is striking how frequently we find lithological types that are considerably distant from what one would expect of a granite *berrocal*, such as limestone or alluvial deposits.

The photo-interpretation of the SIGPAC images of the 154 entries that show no ambiguities in their names and furthermore are found on granite terrains did not allow us to locate even a granite outlay in all cases; it must also be said that on some occasions the toponym appeared in zones with granite rocks on the surface but in rather ordinary forms.

According to this, 134 of the 154 entries have a *berrocal*-like landscape in the broad sense in their surroundings, whereas in 20 cases we were not able to observe this correspondence between the toponym and the landscape. It is, however, important to stress that of these 20 toponyms, the majority (13 to be exact) are entries that originally were not located on granitic terrains, which means that only 7 toponyms located strictly on this type of lithology do not have a *berrocal*-like landscape.

On the other hand, the entries considered positive are not located proportionally to the surface occupied by different types of granite rocks on the Iberian Peninsula (see Table 4), and thus the biotitic granitoids are clearly over-represented, the peraluminous granitoids show a reasonable equilibrium and the rest of the formations have a percentage of toponyms lower than what should correspond to them according to their area size. The chi test indicates that this circumstance has a less than 1% chance of being random. But the concentration of toponyms from this family on biotitic granites does not seem to have so much to do with the type of rock as with the fact that it is these granitoids that dominate the focal or central distribution zone of this kind of toponym, that is, the Avila-Madrid sector mentioned earlier.

In short, the toponyms of the *berrocal/berrueco* family that are not ambiguous from the linguistic point of view are only good indicators of the granite boulder landscape in 2/3 of cases (66.34%), always taking into account that the sample of toponyms used came from the Geo-referenced Toponym Database of the CNIG (Spanish National Centre for Geographic Information).

IV. CONCLUSIONS

The toponyms of the *berrueco/berrocal* family show a quite concentrated distribution, such that it can be considered a local denomination that has a western variant (*barrueco*). The fundamental nucleus is found in the mountain ranges of Avila and Madrid, with extensions towards Salamanca and Cáceres, and to a lesser extent towards Toledo and Segovia.

There is undoubtedly a very close relation between this kind of toponym and landscapes characterized by the presence of granite boulders on the surface. However, around a third of these toponyms turn out to be a deficient indicator of this type of landscape.

Although we cannot know whether the predictive capability of other toponyms is similar to this case, it seems reasonable to assume that the value of place names as indicators is not absolute, and it is therefore necessary to act with prudence when attempting to infer something based on the toponym.