

## **Patterns of the foreign contributions in some domestic vs. international journals on Earth Sciences.**

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**This is an author post-print (ie final draft post-refereeing) of the paper published in *Scientometrics*, 59, 1 (2004): 95-115**

### **Abstract**

Patterns of the foreign contributions published in six scientific journals on Earth Sciences published in different countries, have been studied as an approach for testing their level of internationalisation. Two of the multiple dimensions that determine the internationalisation of scientific journals are considered: the geographical distribution pattern of authors and the co-authorship linkages among them. The potential of the said journals to attract manuscripts by foreign authors and to promote international collaboration, through the publishing of co-authored papers involving or not scientists by its own country of publication, is investigated. Some other indicators on the degree of internationalisation of scientific journals, such as, language of publication, publishing institution, and national structure of editorial boards, are also considered. Finally, the geographic areas, the journal papers deal with, can be introduced as a new aspect of internationalisation. Three categories of journals clearly differentiated are identified and characterised: domestic, regional and international journals. The effect on publication and collaboration patterns, of geopolitical, cultural, economic and linguistic bonds among countries is discussed. The important role of domestic European journals on Earth Sciences is noted, as they are not only the main information source on the research carried out by local scientists whose study is focused on the geologic features of their country, but also, as

an excellent vehicle of international diffusion for works by foreign scientists from developing countries. On the other hand, international collaborative articles in domestic journals constitute an indicator of the interest of the international community on the scientific studies in the publishing country.

POST-PRINT

## Introduction

Scientific journals are a central node in the scientific communication process. Being science an eminently international activity, the study of journals' internationalisation, of their international visibility and influence, becomes a matter of the utmost importance. The knowledge of journals' characteristics is essential to understanding why articles in some journals gain more attention than articles by the same author or dealing with a similar topic but published in different journals.

Publishing in international prestigious journals (mainstream journals) scientists attain a higher international diffusion and visibility of their research work. Thus, in most cases, they select these journals, particularly those covered by the Science Citation Index (SCI), in preference to others of a more restricted -usually strictly national- circulation (domestic journals). This behaviour varies across scientific disciplines. Differences can be seen in what respect the vehicle scientists use for the dissemination of research results, or the publication and citation habits of scientists depending on the domestic or international nature of journals where they publish.

The different scientific fields and disciplines do not have identical requirements of 'internationalism', nor journal quality can be measured through the same parameters. In most studies dealing with this matter, SCI journals are considered as a model of international journals, resting on the commonly accepted postulate that they cover the international 'mainstream literature'. Therefore, few are the data reported on the international character of national-based, non-SCI journals, and even less frequent studies comparing patterns of these journals with those of international journals of the same discipline.

One measure of the degree of internationalisation of a scientific journal is the inclusion of papers by authors from foreign countries. Cultural, geographical, geopolitical, economic and

linguistic bonds among countries are considered factors behind the capability of a journal to attract foreign contributions. Non-mainstream domestic journals are often characterised as parochial; that is, they attract few authors from foreign countries, and tend to report research on problems of local or domestic interest to be disseminated mainly within the domestic scientific community. This is particularly notable in disciplines or fields concerned with territorial aspects of local interest, as Earth Sciences.

The publication and citation scope, the capability of a journal to promote international collaboration -in particular through co-authorship not involving authors from the country of publication-, and the national structure of editorial boards, are also of interest when analysing scientific journals' internationalisation.

Internationalisation of scientific journals is determined by various dimensions, all of them closely inter-related. Among them we can mention the following (see *Zitt and Bassecoulard*, 1998): 1) the geographical distribution pattern of authors publishing on them; 2) the co-authorship linkages (proportion of co-authorship within and outside the country to which the journal belongs); 3) the internationalisation through publishing choices in terms of language and commercial publishers; 4) the national structure of editorial boards (see also *Martín-Sempere et al.*, 2000.); 5) the nature and publishing policy of the publishing institution (either a commercial publisher, an academic institution or a scientific society); 6) the geographical distribution pattern of users, including readers, subscribers and citers; and 7) the spectrum of international databases including the journal (see also *Rey-Rocha and Martín-Sempere*, 1999).

The present paper focuses on the first two of the above-mentioned dimensions of internationalisation, both closely related with the process of scientific collaboration. A first aim of this article is to characterise the foreign contributions published in six journals on Earth Sciences, as an approach for testing their level of internationalisation. We focus on the distribution of authoring countries in individual contributions, on the one hand, and of partner

countries in international collaborations, on the other. The potential of the said journals to attract manuscripts by foreign authors and to promote international collaboration, through the publishing of co-authored papers involving or not scientists by its own country of publication, is investigated. Some other of the dimensions aforementioned, such as, language of publication, publishing institution, and national structure of editorial boards, are also considered.

Finally, the geographic areas, the journal papers deal with, can be introduced as a new aspect of internationalisation. Aspect that is particularly interesting in scientific fields characterised by territoriality, as Earth Sciences.

The profiles obtained for three domestic journals (two Spanish and one Italian), in relation to those corresponding to a regional (published in France) and two mainstream, international journals (published by two world-leading scientific publishers), are analysed.

## Methods

We selected six scientific journals on Earth Sciences. Two of them are Spanish journals of a 'domestic' shape. Through a survey carried out among Spanish researchers in Earth Sciences (Rey-Rocha and Martín-Sempere, 1999), they have been considered as being the Spanish journals of higher quality in this field. On the other hand, we rely on experts' advice to select two European journals (French and Italian) of characteristics similar to that of the aforementioned Spanish ones. Nevertheless, each one of them has particular characteristics. The Italian, which can be 'a priori' considered as domestic, is published in English. In what respects the French, it can be considered as 'regional', rather than 'local' or 'domestic', due to both its scope (the study of the Mediterranean area) and the composition of its editorial board. Finally, we selected two mainstream international journals, both covered by the SCI.

The selected journal titles are the following:

- *Revista de la Sociedad Geológica de España*. Journal of Earth Sciences, published by the Spanish Geological Society. The editorial board is composed by scientists from 25 different institutions, 80 percent of them Spanish, and the rest from France, Germany and Portugal.
- *Estudios Geológicos*. Journal of Earth Sciences, published by the Spanish National Museum of Natural Sciences, of the Spanish Council for Scientific Research. The editorial board is composed by researchers from 14 different institutions, all of them Spanish.
- *Giornale di Geologia*. Journal of Sedimentary and Marine Geology, published by the Department of Geological Sciences of the University of Bologna (Italy). All editorial board members are Italian.

- *Géologie Méditerranéenne*. Journal published by the Department of Earth Sciences of the University of Provence (France). Both the editor-in-chief and editorial board members are French. The journal also has 'correspondents abroad', from nine different countries: Algeria, Greece, Hungary, Israel, Italy, Spain, Switzerland, Tunisia and ex-former Yugoslavia.
- *Sedimentology*. Journal published in the UK by Blackwell, on behalf of the International Association of Sedimentologists. Editors-in-chief are at the University of East Anglia (United Kingdom), the University of Wollongong (Australia) and the University of Western Ontario (Canada). The editorial board is composed by scientists from six countries: the USA (one third of institutions), Canada, Israel, Netherlands, New Zealand, and the UK.
- *Geomorphology*. Journal published by Elsevier at Netherlands. Editors-in-chief are at the University of Liverpool (UK) and the Oklahoma State University (USA). The editorial board is composed by scientists from thirteen countries: the USA (41.4% of editorial board members), the UK (13.8%), Argentina, Australia, China, Germany, India, Italy, Japan, Netherlands, New Zealand, Poland, and Sweden.

All selected journals are covered by GeoRef (Geological Reference File), one of the most representative international bibliographical databases in the field of Earth Sciences, produced by the American Geological Institute (AGI). Nevertheless, only *Sedimentology* is included by AGI in the Georef list of 'priority journals' (journals whose articles are indexed and included in the database with as much speed as is practical). Both *Sedimentology* and *Geomorphology* are covered by the Science Citation Index.

In the case of *Geomorphology* and *Sedimentology*, data are from issues corresponding to years 1995-1996. For the rest of journals, that publish a lower annual number of originals, we have extend the studied period, including 1997 and 1998, with the purpose of approximating the

number of articles considered to that of the two international journals. All the data and information reported in this paper are about these periods.

Only journal articles have been considered. We disregarded communications to the Catania Annual Meeting, published by the *Giornale di Geologia*, as well as Editorials, Discussions and Revisions included in *Geomorphology*.

By foreign articles, we mean those signed by at least one author from a foreign institution, alone or together with domestic authors. Foreign institutions understood to be those from countries other than the publisher (or, in the case of *Geomorphology* and *Sedimentology*, other than countries of the editors-in-chief). Similarly, domestic articles are those signed only by local authors, i.e. authors from the journal' country of publication. By individual (non-collaborative) articles, we mean those signed by authors from only one country. The Degree of International Openness of journals (DIO) is the percentage of foreign articles. The Degree of International Collaboration (DIC) is the percentage of articles signed by authors from both the country of publication and at least one foreign author.

In order to analyse the distribution patterns of geographic areas journal papers deal with, articles have been geographically referenced (geo-referenced), at the country level. Starting from the title, we assigned to each article the corresponding country that the article is dealing with, in order to identify the geographic areas (countries) predominantly studied in every journal's contributions.

## Results

### *International openness of journals*

The Degree of International Openness is probably the most straightforward indicator of the international openness of scientific journals. It is indeed a very simple index lacking normalisation, thus it is necessary to take into account the weight in the world scientific scene of institutions or countries compared, in order to avoid biased misinterpretations. Not in vain, recognition and impact of a nation or scientific community increases with the publishing size of said nation or community. In a recent study, Katz (2000) has showed not only that a power relationship exists between recognition or impact and publishing size of scientific communities, but also that this phenomenon probably extends from the level of the research group, and perhaps the individual, through to the level of the institution, nation and the global scientific enterprise. In the same manner, it could be expected that international recognition and impact of a journal (and therefore its prestige) also increase with the size of the scientific community, in the particular scientific field, of its country of publication, so that journals published in countries with powerful R&D systems attract the higher number of manuscripts authored not only by local authors, but also by foreign authors, and therefore have a higher degree of international openness.

As shown in Table 1, the higher percentage of foreign articles corresponds to regional and international journals. While in domestic journals this figure does not reach 40% at best, in *Géologie Méditerranéenne* (the 'a priori' considered as regional) and *Geomorphology*, it slightly surpasses 50%, and in *Sedimentology* represents almost two thirds of articles published.

The greater attractiveness for foreign authors of both international journals is, in this case, consistent with the scientific weight of their editors-in-chief' countries of origin. Thus, the USA

and the UK are the world leading countries in scientific output and citations not only at the global scale, but also in the field of Earth and Space Sciences<sup>1</sup>. In the same way, journals' attractiveness corresponds to a great extent with that of their countries of origin, being greater in those journals whose publisher or editors-in-chief are from countries whose papers show a greater attractivity, as measured by the Relative Citation Impact Index. Relative citation attractivity in Earth and Space Science is positive for the UK and the USA, near zero for France, and negative for Italy and Spain (*European Commission*, 1997).

The degree of international openness of journals is also related to the prestige and the more or less international character of the publishing institutions. Among our set of journals, the smallest number of contributions published by foreign authors correspond to *Revista de la Sociedad Geológica de España*, the only journal published by a national Scientific Society; while on the other side *Sedimentology*, published by an international Society, shows by far the highest DIO.

The choice of international prestigious journals for publication, particularly of Citation Index-covered journals, is essential for scientists to enhance international visibility of their research work. This strategy has been argued by *Van Raan* (1997) to be “a major aspect of the ‘internationalization’ of science, regardless of collaboration”. It is expected that not only researchers from countries with small or under-developed R&D systems, but also those from leading countries, use these journals as a reference point for their research. On the other hand, it must be taken into account that internationally co-authored papers have higher attractivity than nationally-oriented papers, especially for less developed countries (*European Commission*, 1997), and are, generally, more cited than ‘single-country’ papers (*Narin and Whitlow*, 1990; *Narin et al.*, 1991) –what has been called by *Van Raan* (1998) the ‘fourth rule’ of international collaboration–. Therefore scientists from these countries could be expected to be the most interested in scientific collaboration with the aim of gaining better access to publishing in journals that provide greater visibility to their research work.

Differences have been found in what respect the proportion of individual versus collaborative articles published. (Table 1). In domestic journals, among 50 and 80 percent of foreign articles are international collaborative ones, i.e. they are signed by authors from at least two different countries. The highest percentage corresponds to *Revista de la Sociedad Geológica de España*. Individual foreign contributions are a discriminant factor between domestic and the rest of journals. This kind of contributions, in the regional and in the international journals, is more frequent than collaborative foreign articles. *Géologie Méditerranéenne* and *Sedimentology* show intermediate values, while in *Geomorphology* most foreign articles are individual (non-collaborative).

The proportion of international collaborative articles involving either the countries of publication or the countries of the editors-in-chief is clearly higher in domestic and regional journals than in the international ones. That is, except in international journals, local institutions appear as partners in most of the international collaborations, which in most cases are bilateral.

No noteworthy differences among the different kind of journals have been found in what respect their Degree of International Collaboration. The DIC is similar in the domestic *Estudios Geológicos* and *Giornale di Geologia* to that of the regional *Géologie Méditerranéenne* and of the international *Sedimentology* (Table 1). The most noticeable difference is indeed between the two international journals. The highest proportion of international collaborative articles is found in *Sedimentology*, journal published by an international society.

Aggregated data of these indicators show that both the Degree of International Openness and the percentage of individual foreign articles are clearly higher in the international journals than in the domestic ones. The regional *Géologie Méditerranéenne* occupies an intermediate place, showing values close to those of the international journals *Geomorphology* and *Sedimentology*. On the contrary, the latter show an average proportion of international collaborative articles

(with and without participation of institutions from the country of publication) slightly lower to that of domestic and regional journals, which show similar values.

Another factor affecting internationality of journals is the national structure of editorial boards (EB). Presence of foreign scientists in the EB can result in an increase in the number of contributions by foreign authors. In our sample of journals, the proportion of articles in which authors from the journal' EB countries are involved, ranges in the international and regional journals from 22.2% in *Géologie Méditerranéenne* to 24.3% in *Geomorphology*. On the other hand, in *Revista de la Sociedad Geológica de España*, the only domestic journal with foreign scientists in its EB, this figure is 0.8%.

Contribution of authors from the journal' EB countries to the set of individual foreign articles amounts to 22% in the French journal, 20.8 in *Sedimentology* and 23.6% in *Geomorphology*. In international collaborative articles, contribution by these authors is also relatively high in these journals, ranging from 23.1% in *Géologie Méditerranéenne* to 33.3% in *Sedimentology*. As far as multi-authored articles with all authors from the same country is concerned, results show that the proportion of contributions by authors from EB countries ranges from 20.8% in *Geomorphology* to 26.3% in *Géologie Méditerranéenne* (see Table 2).

Finally, we have drawn out attention to the internationalisation measured by the rate of foreign articles signed only by authors from countries other than the country of publication or the EB countries. These articles amounts for 19.4% of contributions in the French journal, and show higher figures in *Geomorphology* (23.0%) and *Sedimentology* (28.4%), being extremely reduced in the domestic *Revista de la Sociedad Española de Geología* (2.5%). Regarding to articles co-authored by scientists from the same country, these figures are higher in regional and mainstream journals than in domestic, ranging from 20.8% in *Geomorphology* to 32.1% in *Sedimentology*.

### *Patterns of multiple co-authorship*

Assessment of multiple co-authorship revealed some differences among journals (see Table 2). The average number of authors per article (co-authorship index) is higher in domestic than in international journals, showing *Géologie Méditerranéenne* intermediate figures. This difference is yet appreciable in articles signed by authors from the country of publication, but not in those where all authors are from the same foreign country. This higher value of the index in domestic journals is due to the higher percentage of articles signed by five or more authors from the country of publication. Data also reveal a noteworthy lower percentage of articles by four or more authors in the international journals. In domestic journals, most multi-authored articles are credited by authors from the journal's country of publication. On the contrary, in the regional, as well as in the international journals, multi-authored articles signed by authors from the same foreign country appear in a similar percentage than those signed exclusively by authors from the country of publication. Both in *Géologie Méditerranéenne* and *Geomorphology*, these articles are distributed in a similar percentage between that by authors from the EB countries and that by authors neither from the country of publication nor from EB countries. However, in *Sedimentology* these latter represent a higher percentage than the former.

### *Geographic origin of authors*

Another question arises, that is whether and to what extent the rate of foreign contributions is related to or influenced by authors' geographic origin. Our findings show that the international journals here considered are characterised by the wider geographic profile of authors of articles: they show a wide variety of nationalities, mainly European, while in domestic journals foreign contributions are not only more scarce, but also geographically more concentrated.

Except in *Géologie Méditerranéenne*, most foreign contributions are by authors from Western European countries, which participate in around 50% of foreign articles in international journals, and in between 58 and 65 percent in domestic (Table 1). In the French journal stands out the high percentage of articles signed by authors from developing countries, particularly from Tunisia and Morocco. A similar case is that of *Estudios Geológicos*, a 25 percent of whose foreign contributions come from Argentinean authors. *Sedimentology* stands out again, in this case for presenting the most equitable distribution of foreign works, in what their national origin is concerned.

No substantial differences have been found between collaborative and non-collaborative articles, except in domestic Spanish journals, where Western European authors are mainly involved in collaborative works.

With regard to the nationality of foreign authors of both individual and collaborative articles, the difference observed among domestic and international journals is noteworthy. In the former, individual submissions come from countries differing, in general, from those participating in international collaborations. However, in the latter, with a higher number of partners, the core countries remain mostly unchanged in both types of contributions.

Foreign countries that most contribute in every journal vary noteworthy and reflect, in general terms, the scientific relationships of the countries of publication and the countries of the editors-in-chief<sup>2</sup>.

Both international journals are highly used by authors from the USA, the leading country in Earth Sciences, and the main partner in international co-authorships for most countries (NSB, 1998). In *Sedimentology*, 35% of individual foreign articles and 29.2% of international collaborations, are contributed by USA authors. In *Geomorphology*, percentage of articles by USA authors (73.4% in individual contributions and 43.7% in international collaborations) is

noticeable higher than that by authors from the UK, the other editors-in-chief' country (22.8% and 6.2%, respectively). The corresponding figures for the rest of journals are as follows: in *Géologie Méditerranéenne*, 4% of individual articles and 23% of international collaborations are participated by USA authors; in *Giornale di Geologia*, 14,3% and 28.6%, respectively; in *Revista de la Sociedad Geológica de España*, 0% and 28.6%; in *Estudios Geológicos* there is no contributions by USA authors at all.

Lets now analyse the main countries authoring articles published in every journal. In both Spanish journals, Argentina is the most important country in terms of number of papers contributed. France is the main country partner of Spanish authors in *Estudios Geológicos*, participating in 12% of internationally co-authored articles. In the case of *Revista de la Sociedad Geológica de España*, France and Germany (both represented in the editorial board) are involved in 6,4% of international collaborative papers. Both France and Germany are habitual collaborators of Spain: They figure among the top five Spain' scientific partners (second and fourth position, respectively) in international co-authorships in scientific and technical research, together with the USA, the UK and Italy (NSB, 1998). Furthermore, France is responsible for 6% of foreign citations received by Spanish papers, occupying third position after the USA and the UK. It stands out, together with the abovementioned scarce participation of researchers from the USA, that of UK scientists. Both countries are important scientific collaborators of Spain, particularly in the field of Earth Sciences, where they are, after France, main partners of Spanish scientists (Rey-Rocha, 1998).

In the other domestic journal, the Italian *Giornale di Geologia*, Germany and Austria are the most important countries in terms of proportion of individual articles (5,5% and 4,2% respectively). France is the main country partner, participating in 4,2% of collaborations with Italian authors. France and Germany are, besides the USA and the UK, the most important partners of Italy in terms of international co-authorship in scientific and technical research (NSB, 1998). Note the scarce participation of the USA and the UK. They are important

collaborators of both countries publishers of the domestic journals here considered, but their scientists rarely publish in these journals, as can be expected from countries of such scientific weight, that publish some prestigious journals in the field here concerned.

In the French *Géologie Méditerranéenne*, Tunisia and Morocco figure as the two top ranked authoring countries, participating in 11% and 9,7% of individual articles respectively. Morocco (5,5%) and Germany (4,2%), even though not bringing ‘correspondents abroad’ to the journal, are the two top-ranked partners of French authors in international co-authored papers published in this journal. Tunisia and Morocco (only the first represented by journal’s correspondents abroad), together with Algeria (with correspondents abroad, but not appreciably represented in foreign contributions) and Senegal, are the most important partners of France by degree of affinity, as indicated by the PAI (Zitt et al., 2000). Germany is the second partner of France (behind the USA) in co-authored scientific and technical articles, and third, together with Canada, in citations to French articles. Finally, both Italy and Spain are both important (in terms of gross co-authorships) and preferred (in terms of PAI) partners of France, and participate in the journals with correspondents abroad. Nevertheless, their researchers are not noticeably represented in articles published in this journal, probably due to the fact that both countries publish their respective journals on Earth Sciences.

Lets now consider foreign contributions in the two international journals. In *Geomorphology* individual foreign articles mainly come from Australia (member of the editorial board) (13.0% of these articles), while Italy (2,4%), France and Canada (1.8% each) (only Italy represented in the editorial board) are the first three partners in collaborative papers. In *Sedimentology* individual articles mainly come from the USA (14%) followed by France (4.9%), being again the USA (6.9%) together with Spain (3.9%) the first two partners in collaborative papers.

In what respect patterns of international collaboration of countries involved in the publication and the editorial boards of these two journals, lets firstly mention that network analysis based on

the aggregate total of all scientific fields (*European Commission, 1997*) shows a strong scientific link framework centred at the USA with Canada and the UK. Furthermore, analysis of international co-authorship in Earth and Space Sciences during the period 1990-1995 also places the USA as the leading country (with 54,6% of internationally co-authored scientific papers), followed by the UK (22%), Germany (18.3%), France (17%) and Canada (14.7%) (*NSB, 1998*).

Being the USA a dominant country in the international scientific arena, it interacts actively with a substantial number of countries. Not surprisingly, the most active countries in terms of international co-authorships are the most important partners of the USA by gross volume (Canada, the UK, Germany, France and Japan).

In what respect the UK, the most important partners in terms of gross volume are the USA, Germany, France, Australia, Italy and Canada. Australia and Italy are both important and preferred. In what respect citations, the USA, Germany, France and Canada are the most citing countries. Not surprisingly, the relationships with Australia, New Zealand and South Africa indicate a positive PAI, demonstrating the strength of cultural linkages rooted in history. As a whole, the United Kingdom's international scientific ties are more the result of historical connections than of geographical proximity (*Zitt et al., 2000*)

The USA, France and the UK are important partners of Canada in both international co-authorships and citations. In what respects Australia, maintains intense co-authorship relationships with the USA, the UK, Germany and Canada, countries that are also main citers, together with France, to Australian papers.

Lets finally consider participation of developing countries, or countries with less developed R&D systems. They are represented, although with a reduced number of articles, in all the journals here analysed. Their different contribution from one journal to another is a

phenomenon that must be interpreted in the context of the so-called neo-colonial ties in science (see *Nagtegaal and de Bruin, 1994*). In Spanish journals main contributors are Latin-American countries; in the French, the aforementioned North African Tunisia and Morocco; in the Italian, Turkey. In the international journals, articles come from diverse regions, but mainly from Asia (India, China, etc.).

Relationships with France of the 'North African' group constituted by Morocco and Tunisia, together with Algeria, are described in some detail in the European Report on Science and Technology Indicators (*European Commission, 1997*). This group maintain a relative high activity in Earth and Space sciences, although their absolute number of publications in this field has stagnated since 1985. An absolute majority of their co-publications with Europe have a French co-author, while co-operation of these countries with the USA amounts to only 10-20% of that with France. Practically all countries of the former French Empire in Africa and the Magreb show high probabilistic affinities for France, even though the absolute number of co-authorships is low. In the case of the linkages between France and its ancient colonies, the effects of cultural proximity and economic relationships dominate the effect of geographical distance.

A similar situation is that of the UK and the former British Empire or Commonwealth countries. Apart from Ireland, its most important partners in terms of probabilistic affinity are the African and Caribbean English-speaking countries, the Middle-East and Gulf countries and other Asian countries. As a whole, the United Kingdom's international scientific ties are more the result of historical connections than of geographical proximity.

It stands out the scarce participation of authors from the three bigger Latin-American countries, given their links with some of the countries publishers of the journals analysed, particularly Spain and France. This fact is more remarkable in the case of Mexico –that shows a relative high activity in this field (AI=1.41)– than in the cases of Argentina –with relative low activity

in the Earth Science field (AI=0.83 in 1995)– and Brazil –with an activity rate close to the world average (AI=0.96)–. In any case, participation of Argentinean authors in the Spanish journals is in accordance with the historical relationships between both countries. Not in vain Spain is, together with France and only preceded by the USA, the country with a higher volume of co-authorships with both Argentina and Mexico.

Finally, Turkey, that shows a relative high activity in Earth Sciences (NSB, 1998), maintain stagnant co-authorship links with Europe. Its collaboration with Europe take a greater share than that with the USA (European Commission, 1997), being Italy the second European Turkey's partner country, nearly after the UK, in terms of co-authorships (NSB, 1998).

#### *Language of publication*

The Italian *Giornale di Geologia*, together with *Sedimentology* and *Geomorphology*, are fully published in English. On the contrary, both Spanish journals as well as the French, are published in the respective national languages of their countries of publication, although they have a small percentage of articles written in another languages. English articles represent 20.3% of papers in *Revista de la Sociedad Geológica de España*, 10% in *Estudios Geológicos* and 15.3% in *Géologie Méditerranéenne*. In most cases, papers published in a foreign language correspond to contributions by foreign authors.

The publication language is one of the aspects that can influence the international dissemination of scientific journals. By the fact, in the set of journals here considered, articles signed by only one foreign author are, in general, by authors from countries where the same language than the publisher of the journal is spoken. In the case of the Spanish journals, these articles are mostly by Latin-American authors, and in the French journal by authors from Tunisia and Morocco.

### *Target countries for articles published*

Percentage of geo-referenced articles in every journal is displayed in Table 3, together with the proportion of them whose target country (the country whose territory is object of study in the corresponding paper) is within the journal's country of origin. In domestic journals, as well as in the regional one, percentage of geo-referenced articles (from 89% to 97,5%) is noticeably higher than in the international journals (around 58%). The same difference is observed when analysing the percentage of foreign articles targeted at the journal's country of publication: 39% on average in domestic, 13% in the regional one, and around 3% on average in international journal).

These data indicate a greater focus by domestic journals on research topics of local or national scope and interest. In all cases, percentage of these articles is noticeable higher in collaborative articles than in single country contributions (in international journals, they are always international collaborative articles).

## Discussion

To the light of the data of the present work, and without going into further details about other parameters and characteristics of the journals here considered – some of which have been investigated in previous articles (*Rey-Rocha and Martín-Sempere, 1999; Martín-Sempere and Rey-Rocha, 2000; Martín-Sempere et al., 2000, 2002*) –, the sample can be clustered in three separate categories of journals clearly differentiated. In this sense, the data countersigns the distinction between domestic, regional and international journals. In other words, distinction that stems from the findings (ex post) corroborates ex-ante distinction.

Firstly, domestic journals (*Revista de la Sociedad Geológica de España, Estudios Geológicos* and *Giornale di Geologia*), characterised by a) a low degree of international openness, thus a high percentage of contributions by authors from the journal's publishing country; b) a low proportion of individual foreign contributions; c) being published by a local institution (National Scientific Society, Research Council or University department); d) having an editorial board mostly or completely composed by scientists from local institutions; e) foreign collaborative papers being signed by local scientists in collaboration mainly with colleagues from countries closely linked by geographic, cultural, geopolitical, economic and/or linguistic bonds; f) the low number of country partners in collaborative articles; g) publishing a high percentage of geo-referenced articles, i.e. articles reporting territorially-oriented research; and h) publishing a relatively high percentage of foreign articles targeted at the territory of the own country of publication.

On the other hand, journals of a more international scope, as *Géologie Méditerranéenne, Geomorphology* and *Sedimentology*, characterised by a high degree of internationalisation, as indicated by a) the high percentage of articles signed by authors from countries other than the publisher, b) the high proportion of individual foreign contributions; c) the relevant presence of

foreign scientists in the editorial board, and d) the reduced percentage of articles targeted at the territory of the own publishing country.

In this second group a further division can be settle down, which we already advanced in the introduction of the present paper, and that has been confirmed by the results. On the one hand *Géologie Méditerranéenne*, a journal which we consider as 'regional', published by an institution of national scope (an University department), where foreign contributions mainly come, as in domestic journals, from countries closely linked, but whose focus is at the study of a particular, but multinational, geographic area (the Mediterranean). On the other hand, two typically international mainstream journals (*Geomorphology* and *Sedimentology*). In addition to being the unique of the analysed sample that are covered by the SCI, they differ from *Géologie Méditerranéenne* in: a) the character of the publishing institution (two different universities from two different countries in the case of *Geomorphology*, and an international Scientific Society in the case of *Sedimentology*); b) not delimiting a particular geographic scope; c) publishing an extremely reduced percentage of articles focused at the territory of the publishing countries; and d) foreign contributions being in collaboration with authors from a wider sample of countries. On the other hand, they differ from the domestic and the regional journals by their higher proportion of international collaborative articles not involving the countries of publication.

Geographic proximity, as well as cultural, political, economic and linguistic bonds, have a clear effect over publication patterns and collaboration, which has been reported by some authors (Narin et al., 1991; Katz, 1994; McDonald and Feather, 1995; Cronin and Shaw, 1999; Nagpaul, 1999; Zitt et al., 2000). The data collected in the present work confirm this relationship, since foreign authors who use the domestic European journals for the international diffusion of their works, in general belong to countries that have some kind of bonds with the country of publication of the corresponding journal. Despite the geographically oriented character of the discipline, the attractiveness for foreign contributions of the domestic journals

seems to be more the result of linguistic, historical and cultural connections than of geographical proximity.

The international collaboration index, the national structure of editorial boards, the nature of the publishing institution and the co-authorship patterns could be some factors affecting internationality of journals. A general observation is that basic disciplines have more international collaboration and that internationality enhances visibility, since international articles are published in journals with higher impact factor than articles with domestic or no collaboration. The involvement of foreign countries in the composition of the editorial board appears to be a factor contributing to increase the number of papers by authors from these countries, and so their international visibility. The nature of the publishing institution also seems to have some effect. In the sample analysed, international journals differ from the rest in the multinational composition of the group of editors-in-chief, but also in that they are published by world-leading scientific publishers. Additionally, *Sedimentology*, the journal that better performs in most of the indicators of international openness considered, is published on behalf of a prestigious international scientific association, fact that may positively affect its international openness.

On the other hand, it has been known for some time that research papers bearing multiple addresses tend to be published in reputed journals (*Van Dalen and Henkens, 2001*) and are more frequently cited by other papers (*Lewisson and Cunningham, 1991; Narin et al., 1991*). On the other hand, considering the evaluation criteria and procedures established by many national evaluation agencies, that encourage researchers to publish in SCI journals, it would be expected that papers by foreign authors in those journals show a co-authorship index higher than the corresponding to domestic ones. However, in our sample of journals, we do not observe this tendency, but on the contrary domestic journals show the higher co-authorship indexes. At least in the case of both Spanish domestic journals, this fact is mainly due to the presence of contributions in particular disciplines that require the participation of many authors. Thus, for

instance, there are a number of papers of Palaeontology and Seismic Prospecting participated and signed by big groups of scientists from Spanish institutions, due to its eminently local interest. At least in this case, the higher co-authorship index is not linked to a greater international prestige of journals.

Domestic European journals on Earth Sciences play an important role from a national point of view, as well as, although to a lesser extent, from an international perspective. The most outstanding aspect is that these journals constitute the main information source about research carried out by local scientists whose study is focused at the geologic features of their country, so about research of interest primarily local or national. On the other hand, they constitute an excellent vehicle of international diffusion for the individual works of foreign scientists from countries with less developed R&D systems, mainly from those with some kind of bonds with the country of publication of the journal. Scientists from these countries use European domestic journals, taking advantage of the aforementioned bonds between countries, whereas scientists from developed countries publish in mainstream journals in order to obtain not only a higher international diffusion of their work, but also a greater professional recognition. Finally, international collaborative articles in domestic journals constitute an indicator of the scientific interest of the publishing country for the international community. This is applicable to those works in which the geographic area object of the research is located at the country of publication of the journal.

From the perspective of national science policies, the stimulus to publish in the international domain must be simultaneous to the support of good domestic journals. These journals must include members of the international scientific community in their editorial boards, and adopt more internationalized patterns of publication and circulation, thus contribute to increase the visibility of local scientific output. Nevertheless, the attainment of good and reputed scientific journals is not only dependent on the efforts directed to fulfil these requirements, but have to be supported not only in a good institutional scientific background, but also by a well developed

and powerful national R&D system. In any case, publishers of domestic journals have to face the asymmetry factor, that benefits the scientific leaders, favouring both their scientific institutions, their researchers, and their whole scientific systems, including their journals, in such a way that internationally prestigious journals tend to be reinforced by the so called Matthew effect (*Merton, 1968*), perpetuating its status and making the entry of second-tier journals into the group of mainstream journals very difficult (*Van Dalen and Henkens, 2001*). This difficulty is reinforced by the use of the domestic language by journals edited in non-English speaking countries. In this sense, a further aspect to be considered is the dichotomy that publishers have to face, to use the English as lingua franca of the international community, publishing journals in this language, or, on the contrary, claim their mother language as a way of dissemination not only of the science carried out in their countries, but also of their cultural heritage.

This paper is concerned to some of the dimensions that determine internationalisation of scientific journals. International journals here considered show a set of characteristics that distinguish them from domestic journals, and that contribute to maintain and improve their international visibility and prestige. Characteristics that should be taken into account by publishers of domestic journals if they want their journals to be incorporated to the group of mainstream journals. Nevertheless, the objective of this paper and the considerations here expressed are focused at a particular set of journals in a specific scientific field, so they can not be held as valid for journals in other scientific fields, nor for classes of journals (international, regional, domestic). Further research on the characteristics of international and domestic journals must take into consideration the particular characteristics and dynamics of the scientific field concerned, as well as the particularities of institutions and countries in charge of the publication of journals.

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## **Acknowledgements**

Authors are grateful to Belén Garzón for her help in data handling, and to María Victoria Romero, at the library of Faculty of Geological Sciences of the Universidad Complutense de Madrid, for her always cheerful and efficient collaboration. We also thank anonymous referees for their valuable comments and suggestions, which have very much improved the final version of this paper.

POST-PRINT

Table 1: Indicators of international openness of journals

	Domestic journals				Regional	International		
	RS	EG	GG	Total	GM	GE	SE	Total
<b>Total articles</b>								
n	118	101	72	291	72	165	102	267
Domestic	83.1%	66.3%	61.1%	71.8%	47.2%	47.9%	37.3%	43.8%
Foreign (DIO)	16.9%	33.7%	38.9%	28.2%	52.8%	52.1%	62.7%	56.2%
<b>Foreign articles</b>								
n	20	34	28	82	38	86	64	150
Individual	20.0%	35.3%	50.0%	36.6%	65.8%	81.4%	62.5%	73.3%
International collaboration	80.0%	64.7%	50.0%	63.4%	34.2%	18.6%	37.5%	26.7%
- Int. coll. not involving publishing countries	6.2%	9.1%	21.4%	11.8%	15.4%	50%	50%	50%
- Int. coll. not involving publishing nor EB countries	0.0%	9.1%	21.4%	9.8%	15.4%	18.7%	20.8%	20.0%
<b>DIC</b>	13.6%	21.8%	19.4%	17.9%	18.1%	9.7%	23.5%	15.0%
<b>Contributions in foreign articles, by region (% of total number of articles)</b>								
<b>Total foreign articles</b>								
WE	11.0%	19.8%	25.0%	17.5%	16.7%	27.3%	33.3%	29.6%
NA	4.2%	0.0%	6.9%	3.4%	5.6%	6.1%	20.6%	11.6%
Other	4.2%	18.8%	8.3%	10.3%	34.7%	20.6%	22.5%	21.3%
<b>Individual foreign articles</b>								
WE	1.7%	4.0%	13.9%	5.5%	8.3%	20.6%	15.7%	18.7%
NA	0.0%	0.0%	2.8%	0.7%	1.4%	4.2%	13.7%	7.9%
Other	1.7%	7.9%	2.8%	4.1%	25.0%	17.6%	9.8%	14.6%
<b>Int. Collaborative articles</b>								
WE	9.3%	15.8%	11.1%	12.0%	8.3%	6.7%	17.6%	10.9%
NA	4.2%	0.0%	4.2%	2.7%	4.2%	1.8%	6.9%	3.7%
Other	2.5%	10.9%	5.6%	6.2%	9.7%	3.0%	12.7%	6.7%

RS: *Revista de la Sociedad Geológica de España*; EG: *Estudios Geológicos*; GG: *Giornale di Geologia*; GM: *Géologie Méditerranéenne*; GE: *Geomorphology*; SE: *Sedimentology*.

WE: Western Europe (European Union plus Switzerland and Norway); NA: North-America (USA and Canada).

Table 2: Multi-authorship patterns

	Domestic journals				Regional	International		
	RS	EG	GG	Total	GM	GE	SE	Total
<b>Percentage of articles with n authors</b>								
1 author	15.2	21.8	29.2	21.0	29.2	31.5	21.6	27.5
2 authors	24.6	25.7	25.0	25.1	23.6	32.1	39.2	34.8
3 authors	23.7	18.8	19.4	21.0	22.2	21.2	25.5	22.8
4 authors	15.2	14.8	8.3	13.4	13.9	9.7	7.8	9.0
≥ 5 authors	21.2	18.8	18.0	19.6	11.1	5.4	5.9	5.6
<b>Co-authorship index (CI)</b>	3.4	2.9	3.3	3.2	2.7	2.3	2.45	2.35
<b>Multi-authored articles, all authors from the same country</b>								
- Total (% of total articles)	71.2	56.4	51.4	61.2	52.4	58.2	54.9	56.9
- All authors from the publishing countries	100	89.5	91.9	94.9	50	58.3	46.4	53.9
- (% of multi-authored articles and CI)	(3.9)	(3.3)	(3.6)	(3.7)	(2.9)	(2.8)	(2.3)	(2.6)
- All authors from countries other than the publishing countries	0	10.5	8.1	5.05	50	41.6	53.6	46.0
- All authors from EB countries (other than the publishing countries)	(-)	(2.8)	(3.0)	(2.9)	(2.7)	(2.8)	(2.8)	(2.8)
- All authors from EB countries (other than the publishing countries)	0	0	0	0	26.3	20.8	21.4	21.1
- All authors from countries other than the publishing or EB countries	(2.5)	(3.0)	(2.6)	(2.8)	(2.9)	(2.05)	(2.9)	(2.4)
- All authors from publishing or EB countries	0	10.5	8.1	5.05	23.7	20.8	32.1	25.0
- All authors from publishing or EB countries	(2.8)	(2.8)	(3.0)	(2.9)	(2.9)	(2.05)	(2.9)	(2.4)

RS: *Revista de la Sociedad Geológica de España*; EG: *Estudios Geológicos*; GG: *Giornale di Geologia*; GM: *Géologie Méditerranéenne*; GE: *Geomorphology*; SE: *Sedimentology*

Table 3: Geo-referenced foreign articles and those targeted at the journal' country of publication

	Domestic journals				Regional	International		
	RS	EG	GG	Total	GM	GE	SE	Total
<b>Total articles</b>								
n	118	101	72	291	72	165	102	267
Geo-referenced	97.5%	89.1%	91.7%	93.1%	90.3%	58.8%	58.2%	58.4%
<b>Foreign articles</b>								
n	20	34	28	82	38	86	64	150
Geo-referenced	95.0%	88.2%	82.1%	87.8%	97.4%	67.2%	67.4%	67.3%
Targeted at publishing country	55.0%	29.4%	39.3%	39.0%	13.2%	4.7%	1.2%	2.7%
<b>Foreign Individual articles</b>								
n	4	12	14	30	25	40	70	110
Geo-referenced	75.0%	91.7%	64.3%	76.7%	100.0%	60.0%	67.1%	64.5%
Targeted at publishing country	25.0%	16.7%	28.6%	23.3%	4.0%	0.0%	0.0%	0.0%
<b>Foreign International Collaborative articles</b>								
n	16	22	14	52	13	24	16	40
Geo-referenced	100.0%	86.4%	100.0%	94.2%	92.3%	70.8%	68.8%	70.0%
Targeted at publishing country	62.5%	36.4%	50.0%	48.1%	30.8%	12.5%	6.3%	10.0%

RS: *Revista de la Sociedad Geológica de España*; EG: *Estudios Geológicos*; GG: *Giornale di Geologia*; GM: *Géologie Méditerranéenne*; GE: *Geomorphology*; SE: *Sedimentology*

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## Notes

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1.- Scientific leadership of the USA is clearly reflected by research output figures. From 1990 to 1997, USA scientists participated in more than one third of world scientific articles (*Zitt et al. 2000; European Commission, 1997*). According to data from the Second European Report on Science and Technology Indicators (*European Commission, 1997*), based on data from the Science Citation Index, in the six years immediately prior to the period considered in this paper (i.e. 1990-1995), the USA shared 35.8 percent of world scientific output, followed by the UK (9.2 % of world publications), Japan (8.7%), Germany (7.4%), and France (5.9%). In what respect the rest of countries publishers of the studied journals, Canada ranked seventh (4.7%), Italia eighth (3.5%), Australia ninth (2.4%) and Spain eleventh (2.1%). This scientific leadership is also showed up by citations, with USA scientists receiving 52.5% of world citations in 1993, followed by the UK (9.9%), and Canada (8.9%). France ranked fifth (6.4%), Canada sixth (5.2%), Italy seventh (3.4%), Australia tenth (2.3%) and Spain twelfth (1.8%). In the field of Earth and Space Sciences (that accounted for 5.3% of world scientific articles published in SCI journals in 1995), figures of the abovementioned Report place the USA, the UK and Canada as the most important countries in this field, in what respect both publications and citations. The USA participated in 43% of world publications in 1995, and received 79.9% of 1993 citations. Far away in total number of both publications and citations are the UK (9.9% and 16%, respectively), and Canada (8.9% and 13.3%). France occupied fifth position in publications (6.5%) and fourth in citations received (9.9%); Australia was seventh in publications (5.1%) and sixth in citations (7.9%); Italia ranked ninth in number of publications (2.6%), but performed out of the ten leading countries in citations, together with Spain, that ranked out of this list in both indicators. The USA, Canada and Australia showed a clearly higher-than-average activity in this field, as indicated by its Activity Index (AI) -calculated starting from data by the USA National Science Board (*NSB, 1998*)- and its Relative Specialisation Index (RSI) (*European Commission, 1997*). France and the UK showed a nearly balanced, “average” situation, while Italy and Spain performed slightly lower than average. The

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RSI indicates whether a country or region has a relatively higher or lower share in world publications in a particular field of science than its overall share in world total publications. RSI is closely related to the AI. A description of both indicators and the way they are calculated can be found at the Second European Report on Science and Technology Indicators (*European Commission, 1997, Methodological Annex*).

2.- As indicators of scientific relationship among countries, we considered the following: a) the gross volume of co-authored papers for the period 1991-1995, provided by the USA National Science Board (*NSB, 1998*); b) the percentage of citations received by articles authored by the country considered, from articles by other countries, considering 1995 articles citing 1991-93 publications (*NSB, 1998*); and c) the Probabilistic Affinity Index (PAI), as indicated by *Zitt et al. (2000)*. The PAI removes the effect of size (first rank producers and cooperating countries in the world would be expected to appear at the top of most countries' lists of partners), and is convenient for highlighting small specific relationships. It allows the study of small countries' collaboration behaviour, observable either in an influence zone pattern or in relationships between small actors.