Available online http://amq.aiqua.it
ISSN (online): 2279-7335

Alpine and Mediterranean Quaternary, Vol. 31 (Quaternary: Past, Present, Future - AIQUA Conference, Florence, 13-14/06/2018), 17 - 21

https://doi.org/10.26382/AIQUA.2018.AIQUAconference

MORPHODYNAMICS OF COASTAL AREAS REPRESENTED IN THE NEW GEOMORPHOLOGIC MAP OF ITALY: DRAW THE LANDFORMS OF THE PAST TO OUTLINE THE FUTURE

Alessandro Chelli [1], Domenico Aringoli [2], Pietro P.C. Aucelli [3], Maurizio A. Baldassarre [4], Piero Bellotti [4], Monica Bini [5], Sara Biolchi [6], Sara Bontempi [4], Pierluigi Brandolini [7], Lina Davoli [4], Giacomo Deiana [8], Sandro De Muro [9], Stefano Devoto [6], Gianluigi Di Paola [10], Carlo Donadio [11], Paola Fago [12], Marco Ferrari[7], Stefano Furlani[6], Angelo Ibba [9], Elvidio Lupia Palmieri[4], Antonella Marsico[12], Giuseppe Mastronuzzi [12], Rita T. Melis [8], Maurilio Milella [12], Luigi Mucerino [7], Olivia Nesci [13], Paolo E. Orrú [8], Valeria Panizza [14], Micla Pennetta [11], Daniela Piacentini [13], Arcangelo Piscitelli [12], Nicola Pusceddu [7], Rossana Raffi [4], Carmen M. Rosskopf [10], Paolo Sansó [15], Corrado Stanislao [11], Claudia Tarragoni [4], Alessio Valente [16]

1 Dip. di Scienze Chimiche, della Vita e della Sostenibilità Ambientale, Università di Parma, Parma, Italy
2 Scuola di Scienze e Tecnologie, Sezione di Geologia, Università degli Studi di Camerino, Camerino, Italy
3 Dip. di Scienze e Tecnologie, Università degli Studi di Napoli Parthenope, Napoli, Italy
4 Dip. di Scienze della Terra, Università "Sapienza", Roma, Italy
5 Dip. di Scienze della Terra, Università di Pisa, Pisa, Italy
6 Dip. di Matematica e Geoscienze, Università degli Studi di Trieste, Trieste, Italy
7 Dip. di Scienze della Terra, dell'Ambiente e della Vita, Università degli Studi di Genova, Genova, Italy
8 Dip. di Scienze Chimiche e Geologiche, Università di Cagliari, Cagliari, Italy
9 Oss. Coste e Ambiente Naturale Sottomarino, Dip. di Scienze Chimiche e Geologiche, Università di Cagliari, Cagliari, Italy
10 Dip. di Bioscienze e Territorio, Università degli Studi del Molise, Pesche (IS), Italy
11 Dip. di Scienze della Terra, dell'Ambiente e delle Risorse, Università degli Studi di Napoli Federico II, Napoli , Italy
12 Dip. di Scienze della Terra e Geoambientali, Università degli Studi di Bari "Aldo Moro", Bari, Italy
13 Dip. di Scienze Pure ed Applicate, Università di Urbino, Urbino (PU), Italy
14 Dip. di Storia, Scienze dell'Uomo e della Formazione, Università di Sassari, Sassari, Italy
15 Dip. Scienze e Tecnologie Biologiche e Ambientali, Università del Salento, Lecce, Italy
16 Dip. di Scienze e Tecnologie, Università del Sannio, Benevento, Italy
Corresponding author: A. Chelli <alessandro.chelli@unipr.it>

ABSTRACT: In the framework of the revision of Italian geomorphological legend (CARG Project) published in 1994 by the National Geological Service, the AIGeo-Working Group Coastal Morphodynamic (WGCM) dealt with the revision of the legend concerning the landforms of the coast. The aims of the work were the updating of the symbology on the basis of the post-1994 results in the geomorphological researches and creating a legend more vocated to the solution of the problems of applied geomorphology and more suitable to be managed in GIS environment.
The WGCM started from the critical analysis of the classifications of coastal landforms proposed during the last century and it continued through a scientific discussion on the work that the members of the group performed by means of 12 case studies in which a correlation between landforms, processes and, dynamics was made.
The geomorphological legend proposed by the WGCM has to be considered as a starting point and a work in progress. It remains, indeed, open so that new data can be added and updated as required. Besides, the WGCM tried to contribute to the morphodynamic classification of the coasts around the Mediterranean basin.

KEYWORDS**:** Coastal dynamics, coastal geomorphology, geomorphological mapping, Mediterranean coast

1. INTRODUCTION

The geomorphological map is the basic tool for the representation of landforms of earth topographic relief and, as such, is currently the document present in most of the activities of environmental planning carried out in Italy at the various institutional levels, from the national to the municipal one, with particular reference to the evaluation of geomorphological hazards and the mitigation of the associated risks.

The geomorphological mapping in Italy has reached high levels of scientific value in the description and analysis of the landscape and in returning correct territorial data from the dimensional point of view, as well as providing the necessary geomorphological information useful for the applied purposes in different scientific sectors, such as hydraulics, forestry sciences, agronomy, environmental engineering, architecture, landscape ecology, etc.

Besides, thanks to the capability to represent the state of activity of landforms, and of associated processes of course, the geomorphological mapping is the

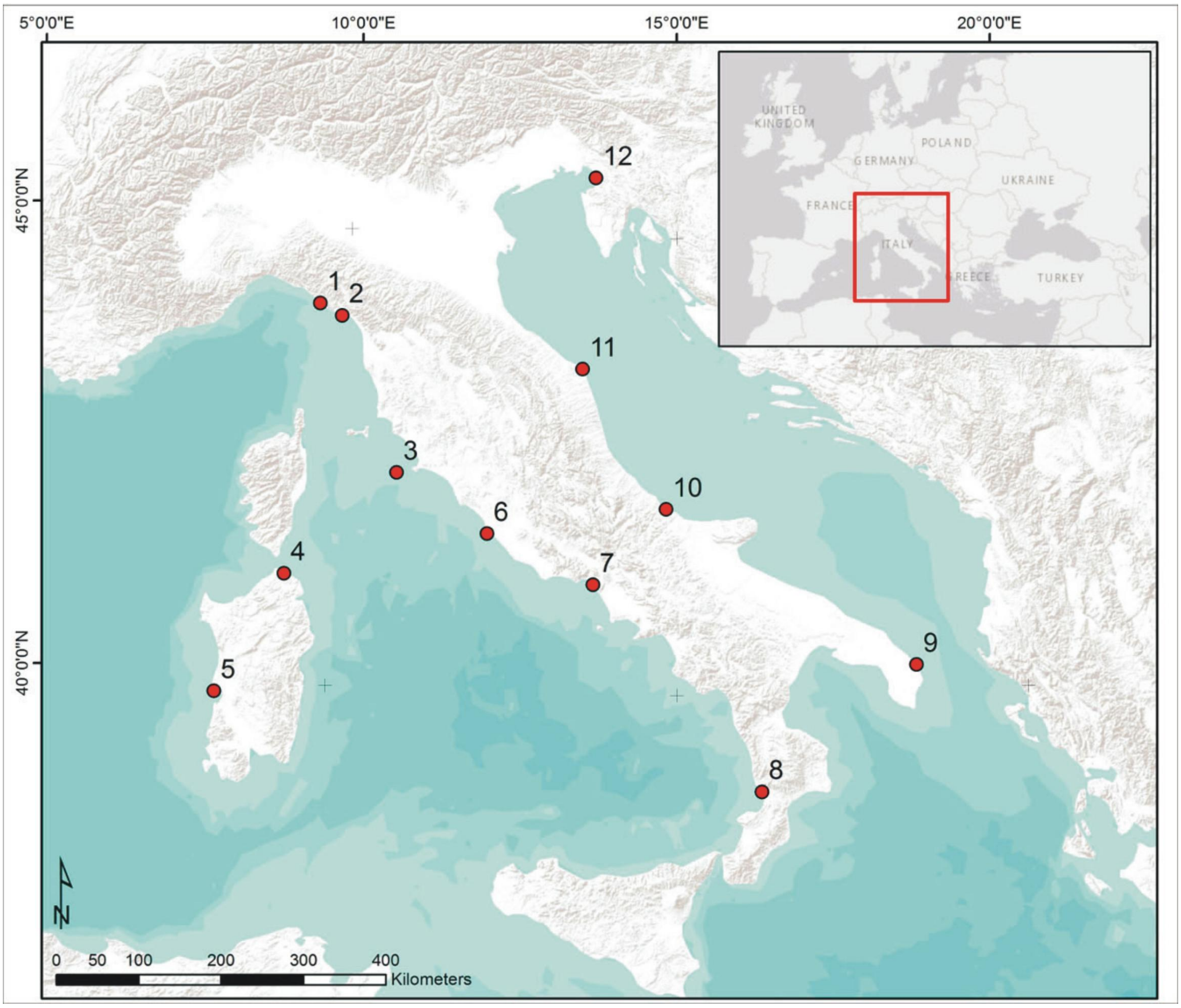

Fig. 1 - Case studies: 1) Bonassola- Levanto rocky coast and embayed beach; 2) Tellaro rocky coast; 3) the Franco Promontory and the Campese Bay; 4) Isola dei Gabbiani Tombolo; 5) the coastal area of Torre San Giovanni - Capo San Marco; 6) the Tiber River Delta; 7) littoral of the Garigliano River Mouth; 8) the La Vota paralic system; 9) the Roca - Sant'Andrea coast; 10) the Northen sector of the Molise Coast; 11) the Northern coastal sector of the Mt. Conero Promontory; 12) the rocky coasts of the Gulf of Trieste (from Mastronuzzi et al., 2017).

primary tool to provide a dynamic view of the landscape.

The legend of the Geomorphological Map of Italy (CARG Project) published in 1994 by the National Geological Service (Brancaccio et al., 1994) represented the first document that summarized the different approaches to the representation of landforms that were developed in Italy by different schools, since the sixties of the last century.

In fact, the current system of Italian geomorphological mapping has its origin from the works of Authors such as Castiglioni (1964) and Panizza (1966) who have also worked in synergy with international groups and from the experience shared through workshops of informal working groups constituted by Italian geomorphologists (GSUEG, 1978; GRG, 1982; GNGFG, 1986; 1987; 1993; 1995).

Since 2015, the Italian geomorphologists community has started, as part of the works of the Italian Association of Physical Geography and Geomorphology (AIGeo), the revision of the 1994' legend, thanks to the work of the Working Groups (WGs) born within the Association.

The WG Coastal Morphodynamic (WGCM), established by AIGeo in 2013, dealt with the revision of the legend concerning the landforms of the coast, dealing with the landforms of wave-climate and eolian origin, these latters having, in the morphoclimatic system that characterizes the Italian peninsula, the best expressions in correspondence of the morphosedimentary dune-beach systems.

The aims of the WGCM were: 1) to implement and update the symbology by introducing the results of the last 25 years of geomorphological research, 2) creating a legend and then a geomorphological map, with a

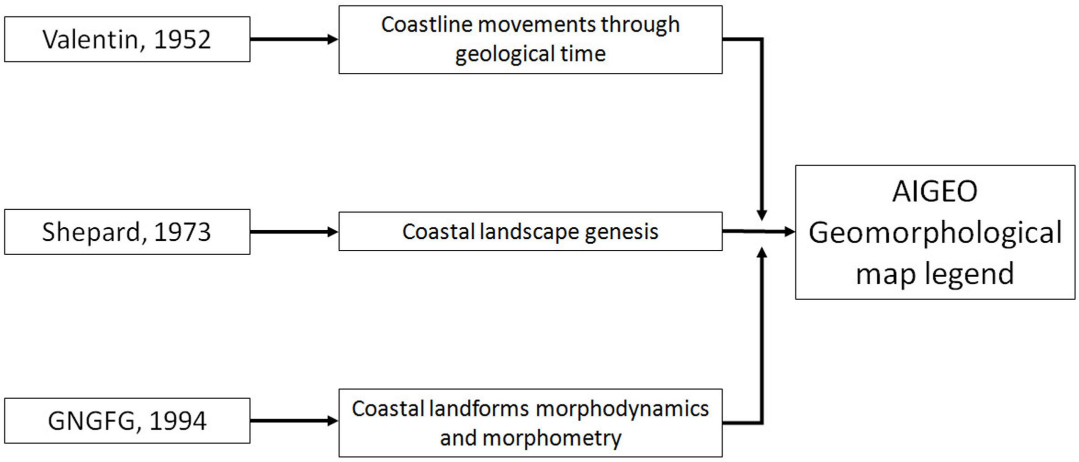

Fig. 2 - Theoretical flow-chart explaining the construction of the new geomorphological legend of the Italian coast. The legend has been built starting from the analysis of the coastal landscape recognising the landform genesis, while considering their evolution and present dynamics in relation to the sea-level history and evolutionary trends of shore/coast-line (from Mastronuzzi et al., 2017).

greater vocation, compared to the current one, towards the solution of the problems of applied geomorphology, such as the analysis of the geomorphological hazards and risks and the exploitation of the geomorphological heritage, and 3) to think to symbols that can be more suitable, than the current one, for the creation of a cartographic system that is even more manageable through the use of GIS tools.

2. THE NEW GEOMORPHOLOGIC LEGEND OF ITALIAN COAST

In the framework of the activities for the new geomorphological legend of the Italian coast, the WGCM, other than the guide to geomorphological mapping of Italy at the scale 1:50,000 (Brancaccio et al., 1994), considered besides the results of the other important study concerning geomorphological mapping of the coasts of Italy, i.e.: the Atlas of Italian Beaches (Atlante delle Spiagge Italiane; Aa.Vv., 1997) based on the results of the “Conservazione del suolo”, “Dinamica dei litorali” sub-project.

The legend here proposed collects recent research advancements carried out by the community of Italian coastal geomorphologists as well as the results of an articulated scientific discussion developed within the WGCM based on the work that the researches performed by means of 12 case studies (fig. 1) in which a correlation between landforms, wave-climate data, and dynamics is presented. The aim has been to summarise the most recent results in mapping the coastal landforms within the context of a long cultural process, involving the Italian scientific community.

The realization of the geomorphological legend was, indeed, the result of a theoretical approach, based also on the critical analysis of the classifications proposed during the last century (see Finkl, 2004 and references therein), and of a coastal landscape analysis, recognising the landform genesis at a regional scale, while considering their evolution and present dynamics (Shepard, 1973) in relation to the sea-level history and evolutionary trends of shore/coast line (Valentin, 1952).

The study focuses, indeed, on the entire coastal perimeter of Italy, including different geodynamic areas, ranging from those characterised by high uplift rates to those stable or subsiding, in the Mediterranean climate region, considered as a single morphoclimatic zone. The latter aspect considers the sea energy as “homogenous”, being only affected by lithology and exposure/fetch of each area. The role of 1) inherited landforms (i.e. hillslope or karst cave in submerged areas), 2) volcanic processes, which can characterise a coastal area, 3) continental processes in coastal areas (i.e.: landslides triggered by non-marine processes) and, 4) anthropogenic factors has been also considered. In order to address these issues, the primary task of this study has been to create a classification of coastal landforms which, compared to any previous descriptive/genetic approaches, will be quantitative and dynamic in relation to processes.

The coastal landforms are mainly classified in function of the genetic mechanism still active in their dynamics, while also taking into consideration inheritance, spatial and temporal scales, as well as potential changes in the architecture of the coastal landscape (Mastronuzzi et al., 2017).

The proposed legend has been subdivided into different thematic layers and at different map scales, reporting morphogenetic, morphometric, and morphodynamic data, and thereby facilitating their input into a Geographical Information System (GIS). In this way, data reported on geomorphological map can be used for several purposes by different stakeholders, from researchers to land-use planners.

With the adopted approach, the required geomorphological analysis of coastal landscapes has to be integrated using qualitative and quantitative data on landform genesis and dynamics. At first, it appeared

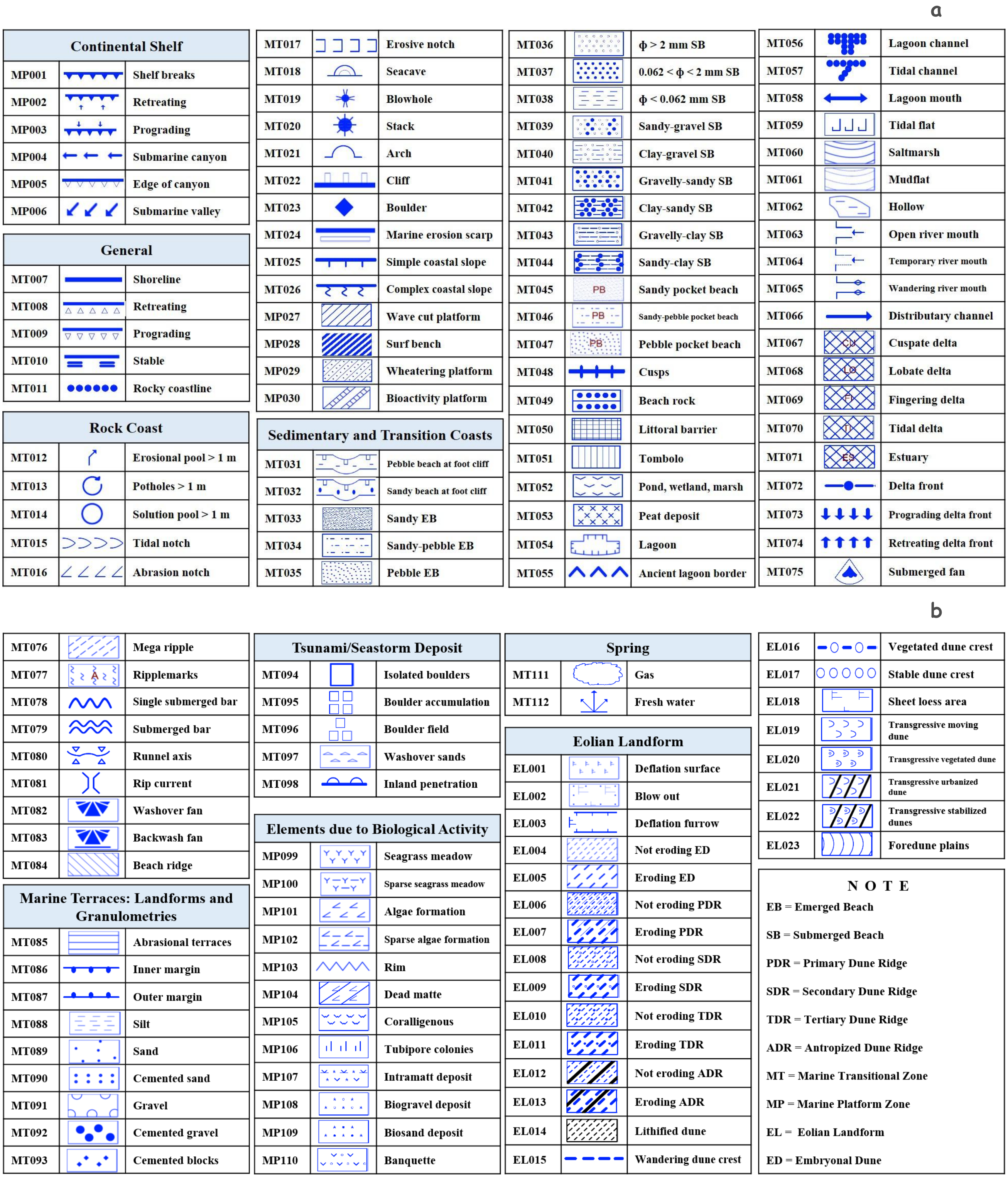

Fig. 3a,b - The new geomorphological legend of the Italian coast (from Mastronuzzi et al., 2017).

useful and necessary to maintain a purely descriptive approach of the coastal landforms and landscapes.

However, from the perspective of the actual “end users”, it then became clearly evident that it would be much more useful to provide genetic and dynamic data. For this reason, in the legend, the description and the genesis of inherited landforms along with the description of their current dynamism have been included.

Information about inheritance and dynamism is especially useful in scenarios where a landform may not correlate to modern dynamic environment. Landforms occurring in rocky coastal environment, such as sea caves and karst caves, both emerged and submerged, can be found in the same place even if their genesis results from two different morphogenetic systems and processes. For example, a marine cave could be the evolution of a karstic cave shaped in fully continental condition subsequently modified by marine erosive/ depositional or biochemical processes as the sea-level reached it.

REFERENCES

Aa Vv. (1997) - Atlante delle spiagge italiane: Dinamismo, Tendenza Evolutiva, Opere Umane. C.N.R. - M.U.R.S.T., SELCA , 108 Tavv.

Brancaccio L., Castiglioni G.B., Chiarini E., Cortemiglia G.C., D’Orefice M., Dramis F., Graciotti R., La Posta E., Lupia Palmieri E., Onorati G., Panizza M., Pannuzi L., Papasodaro F., Pellegrini G.B. (1994) - Carta geomorfologica d’Italia - 1:50.000. Guida al rilevamento. Quad. Serv. Geol. Naz., ser.3, 4, pp. 42.

Castiglioni G.B. (1964) - Osservazioni morfologiche nella conca di Bressanone. Mem. Accad. Patav. SS.LL.AA., 76, 88 pp.

Finkl C.W. (2004) - Coastal Classification: Systematic Approaches to Consider in the Development of a Comprehensive Scheme. Journal of Coastal Research, 20, 1, 166-213.

Gruppo di Ricerca Geomorfologia (GRG) (1982) - Geomorfologia del territorio di Febbio tra il M. Cusna e il F. Secchia (Appennino Emiliano). Geogr. Fis. Din. Quat., 5, 2, 285-360.

Gruppo di Studio delle Università Emiliane per la Geomorfologia (GSUEG (1978) - Geomorfologia dell’area circostante la Pietra di Bismantova (Appennino reggiano). Boll. Serv. Geol. D’Italia, XCVII (1976), 107-214.

Gruppo Nazionale di Geografia Fisica e Geomorfologia (GNGFG) (1986) - Ricerche geomorfologiche nell’alta Val di Peio (Gruppo del Cevedale). Geogr. Fis. Din. Quat., 9, 2, 137-191.

Gruppo Nazionale di Geografia Fisica e Geomorfologia (GNGFG) (1987) - Cartografia della pericolosità connessa ai fenomeni di instabilità dei versanti. Boll. Soc. Geol. Ital., 106, 199-221.

Gruppo Nazionale di Geografia Fisica e Geomorfologia (GNGFG) (1993) - Proposta di legenda geomorfologica ad indirizzo applicativo. Geogr. Fis. Dinam. Quat., 16, 2, 129-152.

Gruppo Nazionale di Geografia Fisica e Geomorfologia (GNGFG) (1995) - Carta geomorfologica del bacino del Trionto. SELCA, Firenze.

Mastronuzzi G., Aringoli D., Aucelli P.P.C., Baldassarre M.A. Bellotti P., Bini M., Biolchi S., Bontempi S., Brandolini P., Chelli A., Davoli L., Deiana G., De Muro S., Devoto S., Di Paola G., Donadio C., Fago P., Ferrari M., Furlani S., Ibba A., Lupia Palmieri E., Marsico A., Melis R.T., Milella M., Mucerino L., Nesci O., Orrú P.E., Panizza V., Pennetta M., Piacentini D., Piscitelli A., Pusceddu N., Raffi R., Rosskopf C. M., Sansó P., Stanislao C., Tarragoni C., Valente A. (2017) - Geomorphological map of the Italian coast: from a descriptive to a morphodynamic approach. Geogr. Fis e Dinam. Quat., 40(2), 161-196.

Panizza M. (1966) - Carta e osservazioni geomorfologiche del territorio di Calopezzati (Calabria). Riv. Geogr. Ital., 73, 1, 40 pp.

Shepard F.P. (1973) - Submarine Geology. Harper and Row, New York, 519 pp.

Valentin H. (1952) - Die Küsten der Erde. Petermanns Geographisches Mitteilungen Ergänzsungheft, 246. pp. 118.

Ms. received: May 15, 2018
Final text received: May 21, 2018