Catalogue of tsunamis generated in Italy and in Côte d'Azur, France: a step towards a unified catalogue of tsunamis in Europe

Stefano Tinti (1) and **Alessandra Maramai** (2)
(1) *Dipartimento di Fisica, Settore di Geofisica, Università di Bologna, Italy*
(2) *Istituto Nazionale di Geofisica, Roma, Italy*

Abstract
This work presents a catalogue of the tsunamis generated in the seas watering the Italian coasts, including the neighbouring area of Côte d'Azur (France). Events generated far from Italy and affecting the Italian coasts are not taken into account here. The catalogue, that we will also call the Quick-Look Catalog (QLC), is organised in three main sections that are named the Quick-Look Table, the Quick-Look Accounts File and the References File, having the respective abbreviations of QLT, QLAF and RF. The QLT is a synoptic table containing the relevant information available for each event, one table row corresponding to one event. More details are provided in the QLAF, where each event is dedicated a specific subsection: here the description of the tsunami includes all essential aspects that are suitably referenced and is preceded by a concise report concerning the tsunami cause. Lastly, the RF is the list of all the papers and publications quoted in the QLT and QLAF. Notice that efforts have been made to qualify each event by means of contemporaneous sources, although later sources and indirect sources, such as existing catalogues, have not been disregarded. Besides, specific recent studies on the events have been given special mention. In this work some general review of the past catalogues of tsunamis and of recent trends in the subject are expressed. Particularly, great attention is given to analysing the CFB of the Italian tsunamis due to Caputo and his collaborators (Caputo and Faita, 1984; Bedosti and Caputo, 1986), the acronym being formed by the ordered initials of the authors. Motivations clarifying the need for a new catalogue of the Italian tsunamis are illustrated circumstantially. The very different philosophies that are at the basis of the CFB and of the present QLC lead to quite diverse products and results, that are summarised by a table where the events included in the CFB and in the QLC are compared: the net effect of the rigorous scrutiny applied to the sources and of the coherent analysis applied to the data is that only 67 events are included in the QLC, which is about one third of the events that can be counted in the CFB.

Key words *catalogue – tsunamis – Italy – Côte d'Azur (France) – tsunamigenic sources*

1. Introduction

Tsunami catalogues are essential tools to compute the tsunami potential of a given region and to determine the degree of tsunami hazards and risk to which a certain segment of coast may be exposed. But catalogues are not only relevant in risk, and related statistical and land-planning, evaluations, but also for many other scientific reasons. Most importantly, they may be an invaluable basis for the delineation of the tsunami sources, for the understanding of the tsunamigenic mechanism, for the knowledge of the tsunami offshore- and nearshore-propagation, and mostly for the comprehension of the tsunami coastal effects, including flooding, damage and destruction, debris transportation, sediment erosion and deposition. To prove

Mailing address: Prof. Stefano Tinti, Dipartimento di Fisica, Settore di Geofisica, Università di Bologna, Viale C. Berti Pichat 8, 40127 Bologna, Italy; e-mail: STEVE@IBOGFS.DF.UNIBO.IT

the relevance that cataloguing has in the development of tsunami research, it is sufficient to go back to the recent history of the last 50 years: tsunami research has evolved by steps, alternating periods of great interest to others of moderate or even no attention, but it is worth noting that each phase of interest renewal, generally triggered by the occurrence of big events, was always first accompanied by the appearance of new tsunami compilations, that were assembled with the spirit of updating, improving and correcting the existing catalogues and of providing firmer grounds to the researchers involved in tsunami studies. For example, the great concern on tsunamis that followed the catastrophic occurrences of the 1960 Chilean and 1964 Alaskan events was paralleled by the publication of a number of regional tsunami catalogues (see for example, Soloviev and Ferchev, 1961, for the USSR; Berminghausen, 1962 and 1968, respectively for the West Coast of South America and the Atlantic Ocean countries; Iida *et al.*, 1967, for the Pacific Ocean; Pararas-Carayannis, 1969, for the Islands of Hawaii).

Likewise, the impressive 1956 Aegean sea tsunami that prompted tsunami research in Europe, endorsed corresponding efforts for compilations of tsunamis in the Greek seas, first, and then in the whole Eastern Mediterranean sea (*e.g.*, Galanopoulos, 1960; Ambraseys, 1962).

After the '60s, the following period of peak interest on tsunamis and related research flourished around 1980-1985, when new catalogues or new versions of previously published catalogues came to light both in Europe and outside Europe: here, we only mention Soloviev and Go's compilations for the Pacific Ocean, that a Russian-to-English translation made available worldwide (1984a,b), the revised Japanese catalogue (Iida, 1984), as well as the papers by Antonopoulos (1980), completing the 1962 Ambraseys' catalogue for the Eastern Mediterranean, and by Papadopoulos and Chalkis (1984) for Greece. Special reference must be made in this context to the first Italian catalogue of tsunamis that was published just in this period, thanks to the efforts of Caputo, who had the important merit of recalling to the international, and, what was mostly needed, to the national community that tsunamis constitute a serious threat to the coasts of the Italian region. The first Italian catalogue, due to Caputo and Faita (1984), and its updated version (Bedosti and Caputo, 1986) are the natural antecedents of the present work and will be given proper acknowledgment and mention later in many points of the paper.

In order to further strengthen the view that tsunami research may be described as a cyclic sequence of flux (high interest) and reflux (low interest), phased with the increase/decrease in tsunami occurrence rate, and that tsunami compilations have always marked the periods of increasing attention, it suffices to mention what has been happening in the last few years. Following a temporary crisis in the late '80s, since then, interest in tsunamis has been steadily growing worlwide, for it has been recognized that tsunamis pose many important scientific problems that are still open (*e.g.*, their generation mechanism is complex), as well as numerous technical puzzles that still await a solution (*e.g.*, devising early alarm systems for civil protection).

In parallel, new catalogues appeared in recent years: examples are the books by Lander and Lockridge (1989) and by Lander *et al.* (1993) concerning the U.S.A. tsunamis, the booklet by Sanchez Devora and Farreras Sanz (1993) on the Mexican tsunamis, and the papers by Soloviev (1990) and Antonopoulos (1990) regarding the tsunamis in the Mediterranean sea. Accordingly, it is not surprising that a new tsunami catalogue is proposed by the authors: it is based on the existing catalogues by Caputo and Faita (1984) and by Bedosti and Caputo (1986), that will be often hereafter mentioned for short with the common code CFB, and it covers the seas surrounding Italy, including a segment of the French coasts (namely the Côte d'Azur). We stress that this catalogue is considered by the authors as the Italian contribution for a more general catalogue covering all of Europe: indeed the catalogue of the European tsunamis could be simply viewed as the union of the catalogues of all regions of Europe, provided that all these follow the same standards and criteria. In this view one event should be included solely in that catalogue to which its source area belongs. The French province of Côte d'Azur is taken into consideration here since from the available tsunami data it is not always easy to distinguish this source zone from the adjacent generation region of the Ligurian sea: therefore the two regions cannot be separated and are taken together as a unique area, or as a unique «subregion», as is called in the catalogue terminology.

Above we have sketched a sort of historical and cultural relationship between tsunami catalogues and tsunami research that gave us the opportunity to mention some of the most relevant examples of tsunami catalogues published sofar and that in a sense permitted us to clarify that today the time is ripe to produce a new catalogue of the Italian tsunamis on the basis of parallel activities being undertaken by other researchers. This is an argument *pro* our catalogue, but it alone is certainly weak, and more specific *pro* reasons will be discussed in the following section where the need for a unified catalogue of the tsunamis affecting Europe will be clearly explained and discussed.

2. Motivations for a new catalogue of Italian tsunamis

2.1. *The catalogues of tsunamis in the European seas*

The first catalogues of tsunamis were the result of the work of scientists who operated following personal schemes, adopting individual criteria, and solving problems on their own. The effect was that catalogue readers and users could have difficulties in dealing with different catalogues because of the lack of standardisation as concerns, *e.g.*, the style, the approach, and the parameter scales. Some examples are useful to clarify the point.

Until the beginning of this century, tsunamis were not considered worthy of independent compilations, and they were included in catalogues of earthquakes (see Mallet, 1852-1854 and Baratta, 1901), of volcanic eruptions (Mercalli, 1883; Baratta, 1897), or of extraordinary natural phenomena. And even earthquake catalogues published later usually attach information on tsunamis while describing the effect of an earthquake that happened to be tsunamigenic (see Sieberg, 1932; Karnik, 1969; Boschi *et al.*, 1995). One of the first compilations devoted to tsunamis concerned all the tsunamigenic regions of the world and was due to Heck (1947), who mostly gathered material from previous earthquake compilations and adopted a schematic presentation style, like Mallet's (1852-1854) for earthquakes: his catalogue is essentially a table and each event is an entry in the table where only the date, a short account and some of the available references are given. Subsequent authors felt the need to introduce specific forms and parameters more pertinent to tsunami description and evaluation. Ambraseys (1962), for example, though sharing Heck's view of using only a few-line strings for each event, gave greater attention to historical references of the classic world (Greek, Roman, etc.), and systematically provided available tsunami data, such as the tsunami run-up observed in the relevant coastal sites as well as the tsunami intensity, after modifying a scale previously introduced by Sieberg. The table format, with very synthetic information provided for each event, was also adopted in later Greek catalogues, such as the Papadopoulos and Chalkis (1984) compilation and the Papazachos *et al.*'s paper (1986), and in the Portuguese catalogue by Moreira (1968). A converse choice was however made by Antonopoulos who in 1980 decided to publish a catalogue of the tsunamis of the Eastern Mediterranean, from a previous Greek version (Antonopoulos, 1973), providing lots of details: each case is dedicated a section, that begins with a few heading lines giving synthetic information on the date, place, local intensities and sources (equivalent to the event entry of the table-catalogues, such as Ambraseys's), but continues giving the phenomenological description of the event together with a discussion of the sources, of which some original relevant passages are also included. But he reverted to the table style in his following work on the Mediterranean tsunamis (1990), that was an acritical collection of preceding compilations. Even Soloviev (1990) published his catalogue of the Mediterranean events in the form of a table, but he added the important concept of event reliability, that is a parameter expressing the degree of the author's confidence on the fact that the event in the catalogue is a real tsunami: he was bound to attach low reliabilities to several entries, indirectly recognizing that many cases included in previous catalogues could hardly be considered tsunamis, but rather should have been taken as anomalous sea behaviours or as false events.

2.2. *The existing Italian catalogue (CFB)*

The philosophy followed by Caputo and his collaborators in assembling the catalogue of the Italian tsunamis (Caputo and Faita, 1984 and Bedosti and Caputo, 1986) is quite atypical and led to a product that is unique, in that it differs from all the preceding and subsequent examples of tsunami compilations. They present the events basically numbered in chronological order (with a few exceptions). For each event they give the heading lines with date, place and, when appropriate, the correlatable earthquake (only epicentral coordinates and intensity) and also give the most relevant passages of the sources in original language: for excerpts in languages other than Italian (*e.g.*, Latin, English) an Italian translation is provided. The peculiarity of the catalogue is that the authors intentionally refrain from expressing their own judgement on the quality of the sources and on the nature of the event, limiting themselves to presenting the sources acritically.

In accordance with the idea of filtering the data as little as possible, they decided to include in their catalogue even those events for which the accounts available were so poor or so low-quality that one could not even conclude they were tsunamis. Their intention was clearly that of avoiding influencing the user with their intermediation, leaving to him the full final responsibility of the evaluation. This policy implies however necessarily some risks. In fact, either the user is aware of the charge left to him by the authors or he is not. In the former instance, he should know that to use the CFB he is required to have sound experience in dealing with the sources used in the CFB itself, that are the historical Italian sources and mostly the classical catalogues covering the Italian earthquakes (forming the CFB backbone: see Mallet, 1852-1854; Perrey, 1848; Baratta, 1901; Cavasino, 1935; Carrozzo *et al.*, 1973). But if the reader has not sufficient experience or skill or if he is not aware of this requirement, he can certainly have difficulties in discriminating good from bad material, which ultimately affects the plane exploitability of the catalogue and reduces its practical value. Conclusively, the CFB can be considered a valuable basis of raw (or almost raw) data, that suitably arranged, elaborated and enriched with additional material, can be used for the production of a catalogue of tsunamis in the traditional sense, that is for the production of a tool that can be used in practical applications by expert – as well as less expert – users. This is our basic viewpoint and this belief gave and gives us the first fundamental motivation for undertaking the compilation of a new catalogue of the Italian tsunamis.

2.3. *The European catalogue*

The second basic reason concerns a more general need that has been maturing noticeably in recent times and applies to all tsunami catalogues: namely the trend of assembling catalogues covering very wide, say continental or oceanic, areas, instead of restricted regional zones. For Europe, this means that the generation of all the existing national, or in any case partial, catalogues must be substituted by a unique catalogue covering all the European seas, *i.e.* the Mediterranean and the Atlantic Ocean, the North and the Norwegian seas, the Black and the Marmara seas. Producing continental tsunami catalogues cannot be realized by simply gathering and putting together the available national catalogues, but it poses a series of new problems, that can be generally named with the simple word of standardisation: a standard catalogue style, a standard treatment of the sources, a standard evaluation of the tsunami characteristics, standard scales and parameters must be decided, and, furthermore, a common basis of data must be established and used. All this can be achieved only by means of the factual collaboration of tsunami experts of different countries. This problem has been addressed in the frame of a recent project financed by the European Union in the area of seismic risk of the Environment programme, that had the acronym of GITEC (Genesis and Impact of Tsunamis on the European Coasts).

The project, which from 1992 to 1995 involved the authors together with a number of tsunami specialists from six European countries, covered many aspects of European tsunamis, including cataloguing. The QLC has been conceived as the effect of the GITEC activities, conforming the general scheme discussed within that project (see Tinti *et al.*, 1995) and can be viewed as the Italian contribution (or module) for the creation of a catalogue covering the whole of Europe, which is suggestively indicated and emphasized even in the title of this paper.

2.4. *The digital data bases*

Today there is a growing need for data bases that can be handled by computers. In the past great efforts were made for the creation of catalogues that could be stored in computer memory and manipulated by computer users. Though any catalogue, seen as a sequence of characters, can be stored in a digital sequential file, the catalogue form most suitable for a digital utilisation is of course the table since it can be easily transformed into indexed files, more appropriate for information search, retrieval and updating: each tsunami event typically corresponds to a file record composed by a sequence of fixed – or variable – length fields where tsunami information is coded or explicitly given as a string of characters. Nowadays, software to create and to handle data bases (DB) either on mainframes or on personal computers (PC) has evolved so much, that a new tsunami catalogue is valuable only if it is conceived from the outset in a form suitable for digital DB users. This implies that certain choices have to be made, posing constraints that were obviously unknown to the catalogues of the past decades, such as the CFB, and gives a further strong reason for the creation of a new catalogue. In the following sections, while illustrating the features of the QLC, we will provide explicit examples. Here we only emphasize that, in parallel with the present version given in the form of a normal paper-article of a scientific journal, a PC DB version has been also produced, suited to be incorporated in a data base regarding the entire European continent (see Tinti *et al.*, 1995).

3. The structure

The catalogue we present in this paper will be called the Quick-Look Catalogue (QLC) and is structured in three main sections, that can be named the Quick-Look Table (QLT), the Quick-Look Accounts File (QLAF) and the References File (RF). The denomination of Quick Look is adopted to signify that effort has been made to compress the available information either into table items (QLT) or in summaries (QLAF) containing all the relevant data on each event. QL is therefore used here in opposition to the name of Full-Version Catalogue (FVC), with which we designate a catalogue form where all the data related to a given event are fully provided: for example, these are the original text of all the pertinent sources (coeval or not) with possible translations into English, the texts of all the scientific studies revising the catalogue events, as well as the data typically in image-form (*i.e.*, tide-gauge analogical records, sketches or pictures of tsunami damage from post-event field campaigns, etc.). It is easy to understand that producing a tsunami FVC is an exacting and ambitious undertaking, that to our knowledge has not yet been accomplished for any regions in the world. We suggest that the QLC may be seen as the first step for the creation of an Italian FVC, stressing however that the full potential of any FVC can be properly exploited only by means of digital DBs and of the related graphic workstations.

3.1. *The Quick-Look Table (QLT)*

The QLT is the first section of the QLC: it is a table where each event corresponds to a single line, consisting of 19 numbered fixed-length fields, arranged in 20 columns, since one field, the event code, is repeated twice at the beginning and at the end of the row for convenience. They provide synthetically: the event code, the tsunami origin time, the region of tsunami generation, a short phenomenological description, the tsunami cause together with some related data, the tsunami intensity, the observed maximum run-up and the event reliability. In the following, we will take into account individually all the fields of the QLT following the order in which they are included in the table.

The event **code** (item 1) is an integer number uniquely identifying the event within the QLC. In the present first version, event codes form a sequence of consecutive integers, the ascending order corresponding to chronological order, but future QLC updates are expected to possibly break either the sequence or the correspondence or both.

Origin times are 5-item data formed by year (**YY**: item 2), month (**MM**: item 3), day (**dd**: item 4), hour (**hh**: item 5) and minute (**mm**: item 6) of the initiation time of the event, as deduced by the sources. For tsunamis generated by earthquakes, the assumed origin time is that of the shock. When one of these items is not known, the corresponding table space is left blank.

The **subregion** (item 7) is the geographic region where the event originated. Along the Italian coasts as many as 15 coastal zones have been identified (see fig. 1), where tsunamis have been observed. Notice that these areas do not cover all the Italian coastlines (*e.g.*, Sardinia is absent, no tsunamis having been ever reported there), nor they are exactly delimited by precise geographic coordinates. Rather they correspond loosely to physiographic denominations that have been chosen in such a way as: 1) to consent the geographic classification of the Italian events with no ambiguous attribution, and 2) to delineate the most relevant tsunamigenic sources. In accord with this double criterion, the contiguous areas of Liguria (Italy) and Côte d'Azur (France) could not be separated and are assumed to constitute a unique single subregion of the QLC. Indeed, if we had introduced two different subregions, we would have found events (*e.g.*, events with codes 40, 49 and 53) that should have been attributed to both, against our assumption. The inopportuneness of dividing the two subregions is reflected even in the definition itself of the QLC, that, as is specified in the paper title, is said to be the catalogue of the tsunamis in Italy and in Côte d'Azur. The further remark regards the word subregion itself. All the geographical partitions of the QLC are called subregions, for they are considered to be portions of one of the regions, namely the Central Mediterranean region, into which the coasts of Europe can be subdivided, and this conforms to the viewpoint of a European catalogue of tsunamis (see Tinti *et al.*, 1995). In the above, we have naturally introduced the subregion field as a means to operate the geographical classification of the tsunamis, pointing out the need for a coastline partition enabling the certain attribution of the events. We stress that our choice is advanta-

Fig. 1. Tsunamigenic subregions of the Central Mediterranean used in the QLC. Notice that Liguria and Côte d'Azur are considered as one subregion, as explained in the text.

Table I. Tsunami reliability scale, modified after Iida (1984).

Degree	Description
0	Very improbable tsunami
1	Improbable tsunami
2	Questionable tsunami
3	Probable tsunami
4	Definite tsunami

geous in a digital DB version of the QLC, because, thanks to this property, this field can be elected to be a DB key-field, by means of which various kinds of extractions from the QLC can be performed.

The **description** (item 8) is a text string where a few-word account of the event is given: only the most relevant phenomena are reported, with special attention to sea retreat and sea flooding and to specifying the most important cities or localities affected.

The event reliability (**rel**: item 9) is a one-figure code ranging from 0 to 4 and corresponding to classes of increasing probability that the event is a tsunami. The QLC basically adopts the scale used by Iida in the tsunami catalogue of Japan (1984), that is however modified mostly for semantic reasons, and is illustrated in table I. This parameter has a fundamental value and cannot be omitted in catalogues of tsunamis, especially for those catalogues spanning very long periods of time and including historical events, for which it is frequent to find uncertain sources and paucity of information. In the QLC the reliability has been evaluated and given for all events. Since we believe that this parameter deserves some further discussion, we will postpone it to a specific section of the paper later on.

The **cause** (item 10) code is a two-capital letter code specifying the cause of the event, following the scheme depicted in fig. 2 and in agreement with the European catalogue guidelines (Tinti *et al.*, 1995). When the tsunami is directly determined by an earthquake, codes ER (short for «earthquake») and EA (short for «earthquake-associated») are used, according to whether the epicenter is on land or offshore. Codes EL (*i.e.* «earthquake landslide») and ES (*i.e.* «earthquake marine slide») are instead used if the tsunami is provoked, respectively, by a subaerial landslide or by a submarine landslide, that in turn has been triggered by an earthquake. Analogously, codes VO and VA (abbreviations respectively for «volcanic» and «volcano-associated») are used when the event can be attributed directly to the activity of a submarine or island volcano (VO), or to a volcano close to the coast (VA). In the QLC, for example, this distinction entails that events attributed to Vesuvius are classed VA, while events attributed to Stromboli are classed VO. The codes VL («volcanic landslide») and VS («volcanic marine slide») would refer to events respectively caused by subaerial or submarine avalanches on the flanks of volcanoes, in correspondence with volcanic activity. In practice, they happen never to be used in this version of the QLC. Furthermore, when the tsunami is excited by a landslide, either subaerial or submarine, that occurs as the effect of gravitative instability and that is not amenable to earthquakes or volcanic eruptions, the respective codes to be used are GL («gravitative landslide») and GS («gravitative marine slide»). Finally, if the cause happens to be unknown, no code is used and the field is left blank.

If the tsunami is of seismic origin (codes ER and EA), some relevant parameters of the generating earthquake are given, desumed from Italian seismic catalogues and always properly referenced. The latitude and longitude of the epicenter, referred as **Lat (N)** (item 11) and **Lon (E)** (item 12) in the headline of the QLT, are measured in degrees and primes towards North and East respectively, whereas the focal **depth** (item 13) is given in kilometers. The epicentral intensity (**Int**: item 14) in MCS scale ranging from I-XII is also provided. Observe first that we prefer using arabic numbers instead of roman numbers in the QLT. Observe also that, in principle, the intensity should be represented exclusively by integer values, but, when uncertainty exists as to the attribution of an earthquake to two contiguous intensity classes, then the common convention of using semi-integer values is adopted: for instance in-

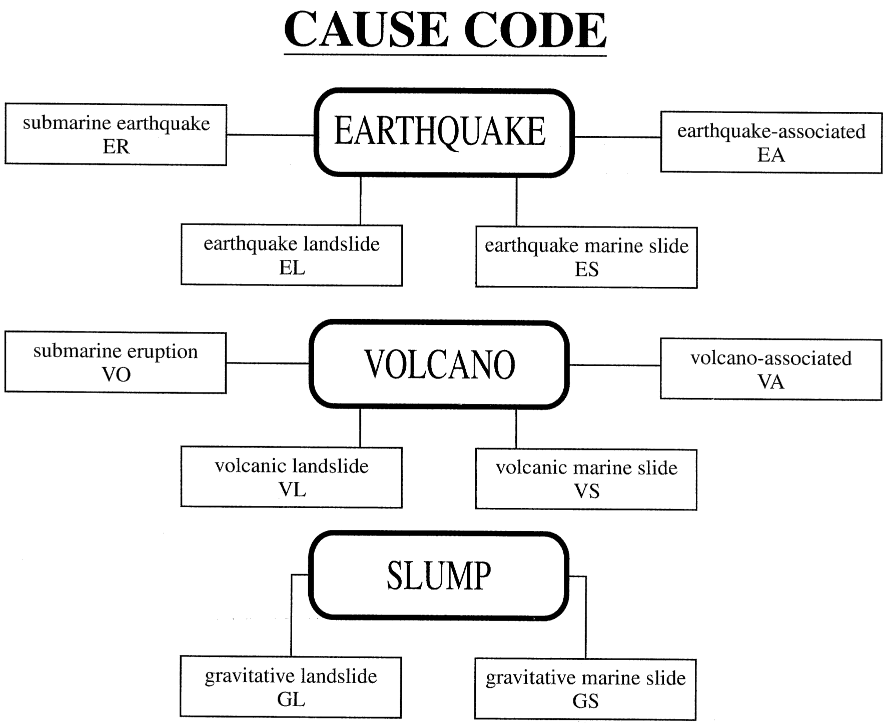

Fig. 2. Illustrative diagram of the codes associated with the possible tsunami causes, used in the catalogue. ER and EA are used when the earthquake has respective epicenter onshore and offshore. Analogously, VO and VA are used when the volcano has a marine or an island cone (see Aeolian islands) or it has an inland cone (see Mt. Etna and Vesuvius). EL, VL and GL refer to subaerial slides, while ES, VS and GS are used for submarine slides.

tensity 9.5 means that the shock cannot be classed IX nor X, but it is attributed the intermediate value IX-X. The earthquake magnitude (**Mag**: item 15) is often the local magnitude, which happens to be either macroseismic or instrumental. In the former case, which generally applies to the historical earthquakes, it is computed from the epicentral intensity on the basis of suitable intensity-magnitude relationships, while in the latter it is usually a duration magnitude computed from records of short-period seismometers.

If the tsunami has a volcanic origin (codes VO and VA), the geographical coordinates of the volcanic cone are given together with the Volcanic Explosivity Index (**VEI**: item 16) of the eruption responsible for the tsunami. The VEI is a scale to measure the size of the eruption and is schematically represented in table II. In the QLC we have found it convenient to take these volcanic data from the world catalogue of volcanic eruptions by Simkin *et al.* (1981).

When the tsunami is generated by a landslide (codes EL, VL, GL and ES, VS, GS) the coordinates of some characteristic point identifying the sliding body (for example its center of mass) should in principle be provided: in practice only two examples can be found in the QLC (event codes 28 and 67) referring to very local episodes, and for them it was considered accurate enough giving the coordinates of the towns where the slide occurred.

Table II. Scheme illustrating the Volcanic Explosivity Index (VEI) scale, after Simkin *et al.* (1981).

VEI	Description	Volume of ejecta (m^3)	Column height (km)(*)	Qualitative description	Classification
0	Non-explosive	$< 10^4$	< 0.1	Gentle-effusive	Hawaiian
1	Small	10^4-10^6	0.1-1	Gentle-effusive	Strombolian Hawaiian
2	Moderate	10^6-10^7	1-5	Explosive	Strombolian Vulcanian
3	Mod-large	10^7-10^8	3-15	Explosive Severe, violent, terrific	Plinian Vulcanian
4	Large	10^8-10^9	10-25	Cataclysmic, paroxysmal, colossal Severe, violent, terrific	Plinian Vulcanian
5	Very large	10^9-10^{10}	> 25	Cataclysmic, paroxysmal, colossal Severe, violent, terrific	Plinian Ultra-Plinian
6	Very large	10^{10}-10^{11}	> 25	Cataclysmic, paroxysmal, colossal Severe, violent, terrific	Plinian Ultra-Plinian
7	Very large	10^{11}-10^{12}	> 25	Cataclysmic, paroxysmal, colossal Severe, violent, terrific	Plinian Ultra-Plinian
8	Very large	$> 10^{12}$	> 25	Cataclysmic, paroxysmal, colossal Severe, violent, terrific	Plinian Ultra-Plinian

(*) For VEI's 0-2, given as km above crater; for VEI's 3-8, given as km above sea level.

Table III. Tsunami intensity scale, after Ambraseys (1962).

i.	*Very light*	Wave so weak as to be perceptible only on tide-gauge records.
ii.	*Light*	Wave noticed by those living along the shore and familiar with the sea. On very flat shores generally noticed.
iii.	*Rather strong*	Generally noticed. Flooding of gently sloping coasts. Light sailing vessels carried away on shore. Slight damage to light structures situated near the coast. In estuaries reversal of the river flow for some distance upstream.
iv.	*Strong*	Flooding of the shore to some depth. Light scouring on man-made ground. Enbankments and dikes damaged. Light structures near the shore damaged. Solid structures on the coasts injured. Big sailing vessels and small ships drifted inland or carried out to sea. Coasts littered with floating debris.
v.	*Very strong*	General flooding of the shore to some depth. Quay-walls and solid structures near the shore damaged. Light structures destroyed. Severe scouring of cultivated land and littering of the coast with floating items and sea animals. With the exception of big ships all other type of vessels carried inland or out to sea. Big bores in estuary rivers. Harbour works damaged. People drowned. Wave accompanied by strong roar.
vi.	*Disastrous*	Partial or complete destruction of man-made structures for some distance from the shore. Flooding of coasts to great depths. Big ships severely damaged. Trees uprooted or broken. Many casualties.

The tsunami intensity (**Tsu Int**: item 17) is a numeric code from 1-6 measuring the size of the event from its observed effects on people, natural environment and human objects and structures and is in a sense based on the same concept as the macroseismic scales for the earthquakes. We adopt here the scale that Ambraseys used for his catalogue (1962) after adapting a prior Sieberg scale and that is given in table III. For each place affected by the tsunami a local tsunami intensity may be evaluated. In the QLT, the maximum value is reported. We observe that when the reliability of an event is too small (namely, 0, 1 or 2), since there is uncertainty even in recognizing if the event is a tsunami, the tsunami intensity is not evaluated.

The next parameter given in the QLT is the maximum tsunami **run-up** (item 18), that is the highest altitude in meters reached by the tsunami on the impacted coasts. For most of the QLC tsunamis no hint can be gleaned from the sources. For a few events, run-ups are available in different places invaded by the waves, and according to our definition only the maximum value goes into the QLT.

The last item (19) of the QLT is the field called **References**: here proper references are given, through identification codes pointing to the RF, for all items shown in the table and taken from literature (typically, the origin times, coordinates of the generating event, earthquake intensity and magnitude, and VEI).

3.2. *The Quick-Look Accounts File (QLAF)*

The QLAF is the second section of the QLC where each catalogue event is treated in a specific module, consisting of four parts: the heading line, the parameter lines, the event account including proper references, and the list of the «further references». The first part identifies the event through the event code, giving also the event date and subregion, all items repeated from the QLT: practically it serves as the title of the module. The second part contains some further relevant items taken from the QLT that are repeated here for reader's convenience, such as the cause and the event reliability. Then the core of the QLAF follows, that is the account of the event. Inspired by Antonopoulos (1980) and by the recent examples of Lander and Lockridge (1989), of Lander *et al.* (1993), and of Sanchez Devora and Farreras Sanz (1993), our basic philosophy is that the catalogue user must be provided with an event description that is compiled by the catalogue authors and that is at the same time: 1) as detailed as the sources available allow, and 2) documented as rigorously as possible. The first part of the account regards the event cause and is generally quite succinct, even for those cases (that are many) where information is extraordinarily abundant, since the catalogue focuses on the tsunami more than on its cause: it serves as an introduction for the following part, concerning the tsunami itself. The tsunami account summarises the phenomena and the effects observed in the different localities and is based on sources that are specifically referenced in the text. It is stressed that a great effort has been made to make preferential use of original coeval sources, that were scrutinized and attentively evaluated in order to strengthen the reliability of the account. Intentionally, original excerpts and passages are not given in the QLAF. As specified in an earlier section, we believe that the QLAF must provide all the essential information maintaining however the cardinal characteristics of being a practical, agile, working tool for the user. Incorporating textual source passages would make it too lengthy and heavy, changing its nature: rather, in our belief, this material must constitute the essence of that kind of catalogue we called the Full-Version Catalogue (FVC). The sources that are not mentioned in the event account are given in the fourth and last part of the event module, under the specification of «further references»: generally they are either posterior sources or indirect sources, such as catalogues of earthquakes and tsunamis, but even coeval sources may happen to fall into this category, if they do not contain more information on the event than that provided by the sources quoted in the preceding account part. The final remark is that recent studies and monographs that are found in the literature concerning the event are given special mention: instead of being included in the «further references» class, they are recalled at suitable points inside the account.

3.3. *The References File (RF)*

The RF is the third section of the QLC and is the complete list of all the references given in the other two sections of the catalogue, *i.e.* the QLT and the QLAF. Each reference is identified through a numeric code that is used whenever a quotation is made. The only observation to be made here is that the list is given in ascending order of the reference code, that, however, corresponds neither to the chronological order of the publications nor to the alphabetic order of the first authors. This is due to the choice of seeing the list as a piling-up open list that can be easily updated whenever necessary: in fact, introduction of new references will simply be made by adding them at the end of the list, with no further rearrangements needed. Of course for a digital version of the RF, any kind of sequencing (per code, per author name, per date, etc.) could accept updating with no problems.

4. The reliability of the events

The reliability of an event of the catalogue is a parameter that expresses the judgement of the catalogue compiler on the probability that the event is a tsunami, according to a specified scale. In our case, the scale adopted is a variant of the Iida scale (1984) given in table I. The changes with respect Iida's are minor, but nevertheless worth noting: both scales consist of five degrees from 0 to 4, degree zero corresponding to Iida's «no tsunami» and to «very improbable tsunami» in the QLC, and degree one corresponding to «very doubtful tsunami» for Iida and to «improbable tsunami» in this catalogue. The main difference is subtle and regards the degree zero since Iida's attribute «no tsunami» is unsatisfactory in our opinion. Indeed, if an event is judged to be «no tsunami», the question arises why it is included in a compilation of tsunamis. All «no tsunami» events should be deleted from a tsunami list, and therefore the wording «no tsunami» becomes useless, since it should never be attached to an entry in a tsunami catalogue. A similar reliability scale was used by Soloviev (1990), who faced the same degree zero problem. His grade «erroneous» may be considered as corresponding to Iida's «no tsunami». It is slightly preferable than Iida's, since it implicitly gives some motivation for the inclusion of the event in the list. In fact, by qualifying a given event as «erroneous», Soloviev seems to state that he takes it into account in his catalogue since in some previous catalogues it was considered a tsunami, but at the same time stating that it was an error. Our idea, however, is that all events of the catalogue must have some probability, from very little to 100%, of being tsunamis, and coherently we have qualified the degree zero as a «very improbable tsunami» case. Adding spurious cases to the list, whatever the motivations and whatever their qualifications (either «no tsunami» or «erroneous») may be, introduces improper elements and can be a source of confusion for the catalogue user. As will be seen in the following section, all events we evaluated as being false events, errors, no tsunamis, etc. have been eliminated from the present catalogue.

The event reliability is important for catalogues comprising historical tsunamis for which data are quite scarce and correspondingly uncertainties are many. If a catalogue compiler should take into account only well documented tsunamis (rated «definite tsunamis» in the adopted reliability scale), he would have no need to use this parameter, but very probably and unfortunately his catalogue would include only few events, and many of the historical records would be detrimentally left out. Therefore, considering historical events often goes together with accepting uncertainties, that in turn can be dealt with satisfactorily only by making use of the reliability parameter.

Attaching the reliability to an event introduces an element of subjectiveness in the catalogue, that cannot be underestimated, nor completely avoided. The authors express their opinion on a certain fact or sequence of facts, and the catalogue reader will use that opinion, the greater his confidence in the professional capacity and experience of the catalogue authors. One way the authors have to improve the grade of objectiveness of their estimates is that of defining criteria for rating events and of applying them with coherence throughout the catalogue. But specifying distinguishing elements and factors helping in classing the events in reliability categories is not at all easy in an explicit and formal way, and no such examples can be found in the literature. In our work we have tried to draft some criteria and some operative methods. Our evaluation criteria take into account both the quality of the sources (rating being made as to the period of the source: coeval or not coeval, as to the author of the source: his cultural level, as to the nature of the source: administrative document, letter, monograph, catalogue, etc.) and the content itself of the reports, that have been systematically analysed in the search for characteristic expressions or keywords, that could help in giving the estimate. Moreover, in order to reduce subjectiveness, all accounts have been examined separately by both authors, with the results then compared, and this has been repeated several times in different periods until the total matching of the estimated reliability was reached.

5. Comparison between the QLC and the CFB

In a previous section it was already pointed out that Caputo and his collaborators had an approach quite different from ours in compiling their catalogue (CFB). Our systematic and rigorous analysis of the sources from a historical, and also from a lexical and semantic point of view, in conjunction with the working assumption of confining the catalogue scope to events generated around Italy, disregarding those affecting the Italian coasts, but generated elsewhere, led us to produce a catalogue containing substantially fewer events than the CFB. Table IV summarises the comparison between the CFB and the QLC, by listing side by side the events in the two catalogues, and evidencing those that are common, the many that are CFB-, but not QLC-events, and those few that are entries of the QLC, but that are not included in the CFB. The table is easy to read, the first two columns reporting the CFB- and the corresponding QLC-event codes respectively: these are sufficient to identify the events, but for convenience the event date (usually only the year, sometimes year, month and day) is also added in the third column. Under the heading «description» the last column specifies the reason for the event deletion from the QLC. We have distinguished a number of categories denoted by capital letters according to what is explained in the following. The code «O» = outside denotes that the event is generated far from Italy, outside the geographic region covered by the QLC, that is outside of all subregions given in fig. 1: in this case the source region provided by CFB is also given. The code «D» = duplicate tells that the event is a duplication of another event, nothing however implying on the latter. False events, *i.e.* events that were erroneously misinterpreted as tsunamis, are designated by «F» = false, and several cases can be also found (*e.g.* CFB 63.1 and CFB 136) that are duplications of false events. Notice, however, that false tsunamis of meteorological origin, that is tsunami-like perturbations due to storms, strong winds, barometric impulses, etc., are classed in a different category and denoted by «M» = meteorological cause. Several cases concern events that were rejected from the QLC because we have no or very poor knowledge of the marine phenomena: descriptions do not mention any phenomena that can be considered typical of a tsunami event. These cases are denoted by «T» = tsunami if the lack of knowledge concerns only tsunami data, and by «TC» = tsunami and cause if it regards both tsunami data as well as the possible causes. On the other hand, we stress that all the cases for which at least some phenomena are reported that are typical of a tsunami, although nothing is known on the causes, have been deliberately included in the QLC, generally with very low reliability: examples are some events occurred in 1885-1886 in the Liguria-Côte d'Azur region affecting Nice (see the Quick-Look Table). A special category is that of the events coded with «S» = seismic. These are events with seismic origin, for which some reliable information may be available on the earthquake as well as on some facts related to the sea (*e.g.* shock felt by sailors in the harbour vessel or offshore), but for which no direct, though minimal, accounted evidence on the occurrence of a tsunami can be found.

Table IV. Comparison between the CFB and the present Tinti and Maramai (TM) catalogue (for the description codes see section 5 of the paper).

Catalogue CFB	Catalogue TM	Date	Description	Catalogue CFB	Catalogue TM	Date	Description
0.1	–	–198	T True date: –126	22	5	1511	
0.2	–	–130	O Dubrovnik	23	–	1538	S
0.3	–	–123	O Greece	24	–	1562	T
0.4	–	46	O Thera Island	25	6	1564	
1	1	79		26	–	1594	D 1538
2	–	177	TC	27	7	1613	
3	–	258	D 262	28	–	1624	S
4	–	262	O Asia Minor	29	8	1627	
4.1	–	344	O Dalmatia	29.1	–	1627	D 30 Jul. 1627
5	–	362	D 365	29.2	–	1627	D 30 Jul. 1627
6	–	365	O Crete	30	9	1631	
7	–	376	D 365	30.1	–	1630	D 17 Dec. 1631
7.1	–	558	T	31	10	1638	
7.2	–	726	O Thera Island	32	11	5 Apr. 1646	
7.3	–	762	D 726	33	–	31 May 1646	S
8	–	792-793	F	34	12	1649	
9	–	963	TC	35	–	1661	F/D 22 Mar. 1661
9.1	–	1010-1011	O Marmara Sea	35.1	–	1666	O Switzerland
9.2	–	1020	O Bavaria	36	–	Apr. 1667	O Dalmatia
10	–	1106	F	37	–	Nov. 1667	O Asia Minor
11	2	1112		38	13	1672	
12	3	4 Feb. 1169		39	–	1682	TC
12.1	–	1169	D 4 Feb. 1169	40	–	1690	D 1693
12.2	–	1170	O Cordoba	41	14	9 Jan. 1693	
12.3	–	1184	D 4 Feb. 1169	41	15	11 Jan. 1693	
12.4	–	1183	D 4 Feb. 1169	42	–	1694	T
12.5	–	1302	D 8 Aug. 1303	43	16	1698	
13	–	23 Jul. 1303	TC	44	–	1699	TC
14	–	1303	O Crete	45	17	2 Feb. 1703	
15	–	1321	F	46	18	2 Jul. 1703	
16	4	1329		47	–	1707	T
17	–	1331	S	47.1	–	1707	O Thera Island
18	–	1343	M	48	19	1714	
18.1	–	1343	D 25 Nov. 1343	49	–	1718-1719	TC
19	–	1348	T	50	–	1723	TC
20	–	1392	TC	51	20	1726	
21	–	1456	S	52	21	1727	

Table IV (*continued*).

Catalogue CFB	Catalogue TM	Date	Description	Catalogue CFB	Catalogue TM	Date	Description
53	–	1730	TC	80	–	1809	TC
54	22	20 Mar. 1731		81	–	1812	TC
55	–	1731	TC	82	–	7 Apr. 1813	S
56	23	19 Jan. 1742		83	36	5 May 1813	
56	–	20 Jan. 1742	M	83	37	19 Jun. 1813	
56	–	27 Jan. 1742	M	84	–	1816	TC
56	–	9 Feb. 1742	M	85	38	1817	
57	24	1743		86	39	20 Feb. 1818	
58	–	1750	T	87	40	23 Feb. 1818	
59	–	1751	S	88	41	9 Dec. 1818	
60	–	1756	S	89	–	8 Jan. 1819	S
61	–	1756	TC	90	–	3 Mar. 1819	O Algeria
61.1	–	23 Jun. 1756	D 1756 (61)	91	–	1820	TC
61.2	–	9 Aug. 1756	D 1756 (61)	92	–	1821	O Patras
62	25	1760		93	–	20 Mar. 1822	TC
63	26	1774		94	–	10 Apr. 1822	TC
63.1	–	1781	F/D 1782	95	42	1823	
64	27	5 Feb. 1783		96	–	1824	TC
65	28	6 Feb. 1783		97	–	1826	S
65	29	7 Feb. 1783		98	–	1828	TC
–	30	1 Mar. 1783		99	43	1828	
66	31	28 Mar. 1783		100	–	26 May 1831	S
67	–	15 Feb. 1783	T	101	–	2 Jul. 1831	T
68	–	11 Jun. 1783	T	102	44	1832	
69	–	20/22 Jun. 1783	TC	103	45	1836	
70	32	7 Jan. 1784		104	–	1838	TC
71	–	9 Jan. 1784	TC	104.1	–	1843	TC
72	33	19 Jan. 1784		105	–	1845	TC
72.1	–	1790	D 5 Feb. 1783	106	46	14 Aug. 1846	
73	–	1790	D 5 Feb. 1783	107	–	26 Aug. 1846	F
73.1	–	1794	O Turkey	108	–	1846	T
74	–	1802	M	109	–	1846	T
75	–	1804	TC	110	47	1847	
76	34	1805		111	–	1850	TC
77	–	1806	T	112	–	1851	TC
78	35	1808		113	–	1852	TC
79	–	1809	TC	114	–	1853	F
79.1	–	1809	D 1809 (80)	115	–	1854	S

Table IV (*continued*).

Catalogue CFB	Catalogue TM	Date	Description	Catalogue CFB	Catalogue TM	Date	Description
116	–	1855	O Algeria	139	–	1896	S
117	–	1856	O Algeria	140	–	1903	TC
118	–	1862	M	141	56	1905	
119	–	1867	O Peloponnesus	142	57	1906	
120	–	24 Jun. 1870	O Aegypt	143	58	1907	
121	–	29 Jul. 1870	O Albania	144	59	1908	
122	–	Oct./Nov. 1870	TC	145	–	1914	T
123	–	1871	TC	146	60	1916	
124	48	1875		147	61	1919	
125	–	1876	TC	148	–	22 Oct. 1919	S
126	–	1880	TC	149	62	1926	
127	49	1885		150	63	1930	
128	–	27 Aug. 1886	O Peloponnesus	151	–	1939	S
129	50	11 Nov. 1886		152	–	1940	T
130	51	17 Dec. 1886		153	–	1941	T
131	52	1887		–	64	1944	
132	53	1888		154	65	1954	
133	54	1889		154.1	–	1956	O Aegean Sea
134	–	1892	S	–	66	1968	
135	55	1894		154.2	–	1978	TC
136	–	1895	F/D 1 Nov. 1895	154.3	–	1979	O Yugoslavia
137	–	1894	S	154.4	–	1979	O Yugoslavia
138	–	1 Nov. 1895	T	–	67	1979	

Acknowledgements

The authors are sincerely indebted to all colleagues collaborating for an European catalogue of tsunamis within the international project GITEC posing the basis for a standard scheme to which to conform regional catalogues, and mostly to Prof. Luis Mendes Victor, Dr. Maria Ana Baptista, Dr. Gerassimos Papadopoulos, Dr. C. Harbitz and Dr. Philippe Heinrich. The authors wish to acknowledge that this paper takes into account the preparatory report RPT 124/94 entitled «Struttura critica delle schede relative a maremoti storici dal 198 a.C. al 1974 citati nei cataloghi italiani», written by SGA under a contract stipulated with the Dipartimento di Fisica of the University of Bologna in the framework of the aforementioned GITEC project. This work has been partially covered by funds of the European Union under the contracts EV5V-CT92-0175 (GITEC) and ENV4-CT96-0297 (GITEC-TWO). It has been also partially financed by the Italian Consiglio Nazionale delle Ricerche (CNR) and the Ministero dell'Università e della Ricerca Scientifica e Tecnologica (MURST).

REFERENCES

AMBRASEYS, N.N. (1962): Data for investigation of seismic sea waves in the Eastern Mediterranean, *Bull. Seism. Soc. Am.*, **52**, 895-913.

ANTONOPOULOS, J. (1973): *Tsunamis of the Anatolian Region from the Antiquity until Today*, Athens (in Greek).

ANTONOPOULOS, J. (1980): Data from investigation of seismic sea-wave events in the Eastern Mediterranean from the birth of Christ to 1980 A.D., *Ann. Geof.*, **33**, 141-248.

ANTONOPOULOS, J. (1990): Data for investigating tsunami activity in the Mediterranean Sea, *Science of Tsunami Hazards*, **8**, 39-52.

BARATTA, M. (1897): *Il Vesuvio e le sue Eruzioni. Dall'Anno 79 d.C. al 1896*, Roma.
BARATTA, M. (1901): *I Terremoti d'Italia* (F.lli Bocca, Torino).
BEDOSTI, B. and M. CAPUTO (1986): Primo aggiornamento del catalogo dei maremoti delle coste italiane, in *Atti Accademia Nazionale dei Lincei, Rendiconti Classe Scienze Fisiche, Matematiche, Naturali*, Roma, serie VIII, **80**, 570-584.
BERMINGHAUSEN, W.H. (1962): Tsunamis reported from the West Coast of South America, *Bull. Seism. Soc. Am.*, **52**, 915-921.
BERMINGHAUSEN, W.H. (1968): *Tsunamis and Seismic Seiches Reported from the Western North and South Atlantic and the Coastal Waters of Northwestern Europe*, Informal Report, Naval Oceanographic Office, Washington D.C. 20390, September 1968, pp. 48.
BOSCHI, E., G. FERRARI, P. GASPERINI, E. GUIDOBONI, G. SMRIGLIO and G. VALENSISE (1995): *Catalogo dei Forti Terremoti in Italia dal 461 a.C. al 1980*, ING-SGA, Bologna.
CAPUTO, M. and G. FAITA (1984): Primo catalogo dei maremoti delle coste italiane, in *Atti Accademia Nazionale dei Lincei, Memorie Classe Scienze Fisiche, Matematiche, Naturali*, Roma, serie VIII, **17**, 213-356.
CARROZZO, M.T., G. DE VISINTINI, F. GIORGETTI and E. IACCARINO (1973): *General Catalogue of Italian Earthquakes*, Comitato Nazionale Energia Nucleare, RT/PROT (73)12, Roma.
CAVASINO, A. (1935): *I Terremoti d'Italia nel Trentacinquennio 1899-1933*, Appendix vol. IV, sez. III «Memorie del R. Ufficio Centrale di Meteorologia e Geofisica», Istituto Poligrafico dello Stato, Roma.
GALANOPOULOS, A.G. (1960): Tsunamis observed on the coasts of Greece from antiquity to present time, *Ann. Geofis.*, **13**, 369-386.
HECK, N.H. (1947): List of seismic sea-waves, *Bull. Seism. Soc. Am.*, **4**, 269-286.
IIDA, K. (1984): *Catalog of Tsunamis in Japan and its Neighbouring Countries*, Department of Civil Engineering, Aichi Institute of Technology, Japan, pp. 52.
IIDA, K., D.C. COX and G. PARARAS-CARAYANNIS (1967): *Preliminary Catalogue of Tsunamis Occurring in the Pacific Ocean*, University of Hawaii, Honolulu, pp. 274.
KARNIK, V. (1969): *Seismicity of the European Area* (D. Reidel Publishing Company, Dordrecht, the Netherlands).
LANDER, J.F. and P.A. LOCKRIDGE (1989): *United States Tsunamis (Including United States Possessions) 1690-1988*, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, National Geophysical Data Center, Boulder, Colorado, August 1989, pp. 265.
LANDER, J.F., P.A. LOCKRIDGE and M.J. KOZUCH (1993): *Tsunamis Affecting the West Coast of the United States*, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, National Geophysical Data Center, Boulder, Colorado, December 1993, pp. 242.
MALLET, R. (1852-1854): *Catalogue of Recorded Earthquakes 1606 B.C.-1850 A.D. Reports on the State of Science. Third Report on the Facts of Earthquake Phenomena*, British Association for the Advancement of Science, London.
MERCALLI, G. (1883): *Vulcani e Fenomeni Vulcanici in Italia*, Milano.
MOREIRA, V.S. (1968): *Tsunamis Observados en Portugal*, Serviço Meteorológico Nacional, RT 993, Publicaçao Geo 134, Lisboa, pp. 12 (in Portuguese).
PAPADOPOULOS, G.A. and B.J. CHALKIS (1984): Tsunamis observed in Greece and surrounding area from antiquity up to present times, *Mar. Geol.*, **56**, 309-317.
PARARAS-CARAYANNIS, G. (1969): *Catalog of Tsunamis in the Hawaiian Islands*, World Data Center A, Tsunamis, Coast and Geodetic Survey, United States Department of Commerce, pp. 94.
PAPAZACHOS, B.C., CH. KOUTITAS, P.M. HATZIDIMITRIOU, B.G. KARACOSTAS and CH.A. PAPAIOANNOU (1986): Tsunami hazard in Greece and the surrounding area, *Ann. Geophys.*, **4**, 79-90.
PERREY, M.A. (1848): Mémoire sur les tremblements de terre de la Peninsule Italique, in *Mémoires Couronnés et Mémoires des Savants Etrangers*, Académie Royale de Belgique, **22**, pp. 145, Bruxelles.
SANCHEZ DEVORA, A.J. and S.F. FARRERAS SANZ (1993): *Catalog of Tsunamis on the Western Coast of Mexico*, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, National Geophysical Data Center, Boulder, Colorado, January 1993, pp. 79.
SIEBERG, A. (1932): *Untersuchungen über Erdbeben und Bruchschollenban im östlichen Mittelmeergebiet*, Denkschriften der Medizin-Naturwissenschaftlichen Gesellschaft zu Jena, Jena.
SIMKIN, T., L. SIEBERT, L. MCCLELLAND, D. BRIDGE, CH. NEWHALL and J.H. LATTER (1981): *Volcanoes of the World*, Smithsonian Institution, Hutchinson Ross Publishing Company, Stroudsburg, Pennsylvania.
SOLOVIEV, S.L. (1990): Tsunamigenic zones in the Mediterranean Sea, *Natural Hazards*, **3**, 183-202.
SOLOVIEV, S.L. and M.D. FERCHEV (1961): Summary of data on tsunamis in the USSR, *Bull. Council for Seism. Acad. Sci. USSR*, **9**, pp. 37.
SOLOVIEV, S.L. and CH.N. GO (1984a): *A catalogue of Tsunamis on the Western Shore of the Pacific Ocean*, Academic of Sciences of the USSR, Nauka Publishing House, Moscow, 1974, Translation by Canada Institute from Scientific and Technical Information, National Research Council, Ottawa, Ontario, Canada, pp. 439.
SOLOVIEV, S.L. and CH.N. GO (1984b): *A catalogue of Tsunamis on the Eastern Shore of the Pacific Ocean*, Academic of Sciences of the USSR, Nauka Publishing House, Moscow, 1975, Translation by Canada Institute from Scientific and Technical Information, National Research Council, Ottawa, Ontario, Canada, pp. 285.
TINTI, S., I. GAVAGNI, A. MARAMAI, A. PIATANESI, C. VANNINI and S. ZANOLI (1995): *GITEC Final Scientific Report*, Chapter 1, 1.1-1.29.

(received July 26, 1996;
accepted October 25, 1996)

QUICK-LOOK TABLE

First section of the Quick-Look Catalogue

Legenda

Item	Denomination	Explanation
1	**Code**	Identification code of the event.
2-6	**YY, MM, dd, hh, mm**	Date of the event: year, month, day, hour and minute. For earthquake-induced tsunamis it corresponds to the earthquake origin time.
7	**Subregion**	Subregion where the event was generated and mainly observed (see fig. 1).
8	**Description**	Most relevant phenomena together with corresponding localities related to the event.
9	**Rel**	Event reliability according to the modified Iida scale (see table I).
10	**Cause**	Code of the cause of the event (see fig. 2).
11-12	**Lat (N), Lon (E)**	Geographical coordinates of the earthquake epicenter, of the volcanic cone or of a representative point of the landslide for tsunamis respectively generated by a shock, by an eruption and by a slide. Coordinates are expressed in degrees and minutes.
13	**Depth**	Hypocentral depth in kilometres of the earthquake generating the tsunamis.
14	**Int**	Epicentral intensity in MCS scale of the generating earthquake.
15	**Mag**	Local magnitude of the generating earthquake.
16	**VEI**	Volcanic explosivity index of the eruption associated with the tsunami (see table II).
17	**Tsu Int**	Tsunami intensity after the Ambraseys scale (see table III).
18	**Run-up**	Maximum run-up observed measured in meters.
19	**References**	Here references related to the previous items are given. For example, by 2-6: (2) it is denoted that items from 2 to 6 (*i.e.* the event date) are taken from reference (2), listed in the RF, that is from ING, 1991.

Code 1	YY 2	MM 3	dd 4	hh 5	mm 6	Subregion 7	Description 8	Rel 9	Cause 10
1	79	9	25			Campania	Sea retreat due to Vesuvius eruption	2	VA
2	1112	6	20			Campania	200-step sea retreat in Naples	0	
3	1169	2	4			Messina Straits	Flood at Messina: city walls destroyed	3	ER
4	1329	6	28			Eastern Sicily	Mt. Etna. Boats carried to the sea at Mascali	0	VA
5	1511	3	26	14	30	North Adriatic	Large sea level rise at Trieste	3	EA
6	1564	7	20	18	30	Liguria-Côte d'Azur	Inundation at Antibes. Damage in Nice	4	EA
7	1613	8	25	4	30	Messina Straits	Sea flooding at Naso	2	EA
8	1627	7	30	11		Gargano	2-mile sea withdrawal and flooding	4	EA
9	1631	12	17	9		Campania	Sea withdrawal in the Gulf of Naples	4	VA
10	1638	3	27	15	05	Tyrrhenian Calabria	2-mile sea retreat at Pizzo Calabro	2	EA
11	1646	4	5	22		Tuscany	Sea level rise and ships grounded in Leghorn	4	EA
12	1649	1				Messina Straits	Shipwrecks in the harbour of Messina	0	EA
13	1672	4	14	16	15	Central Adriatic	Sea retreat and flooding at Rimini	4	ER
14	1693	1	9	21		Eastern Sicily	Anomalous sea movement at Augusta	0	ER
15	1693	1	11	13		Eastern Sicily	Large sea withdrawal and flooding at Augusta	4	EA
16	1698	5	14	10		Campania	Anomalous sea oscillations in Naples	2	VA
17	1703	2	2	10		Latium	Small sea withdrawal at the Tiber mouth	0	EA
18	1703	7	2			Liguria-Côte d'Azur	Sea retreat in Genoa	2	ER
19	1714	6	30			Campania	Repeated sea withdrawals in Naples	0	VA
20	1726	9	1	21	10	Northern Sicily	Sea withdrawal at Palermo	4	EA
21	1727	7	4			Sicily Channel	Sea withdrawal at Sciacca	2	ER
22	1731	3	20	3	15	Gargano	Sea rise at Siponto and Barletta	2	EA
23	1742	1	19	16	30	Tuscany	Sea oscillations in the harbour of Leghorn	4	ER
24	1743	2	20	16	30	Apulia	Sea withdrawal in the harbour of Brindisi	2	EA
25	1760	6	16	15		Campania	Sea retreat in the harbour of Portici	0	ER
26	1774	9	24			Tuscany	Anomalous sea oscillations in Leghorn	0	
27	1783	2	5	12	00	Tyrrhenian Calabria	Strong withdrawals and inundations	4	EA
28	1783	2	6	0	6	Tyrrhenian Calabria	Over 1500 victims at Scilla	4	EL
29	1783	2	7	13	10	Tyrrhenian Calabria	Sea rise at Stilo	2	EA
30	1783	3	1	1	40	Tyrrhenian Calabria	Sea flooding at Tropea	2	EA
31	1783	3	28	18	35	Tyrrhenian Calabria	Sea flooding at Bagnara	2	EA
32	1784	1	7			Ionian Calabria	Sea flooding and destruction at Roccella	2	ER
33	1784	1	19			Messina Straits	Sea flooding and damage at Faro and Catona	2	ER
34	1805	7	26	21	1	Campania	2-3 yards sea rise in the Gulf of Naples	4	EA
35	1808	4	2	16	43	Liguria-Côte d'Azur	Anomalous triple flux/reflux at Marseilles	2	EA

Lat (N) 11	Lon (E) 12	Depth 13	Int 14	Mag 15	VEI 16	Tsu Int 17	Run-up 18	References 19	Code 1
40 49	14 26				5			2-4: (21), 11-12, 16: (1)	**1**
								2-4: (30)	**2**
37 24	15 06		11.0	6.8		4		2-4, 11-12, 14-15: (2)	**3**
37 44	15 00				1			2-4: (40), 11-12, 16: (1)	**4**
46 16	13 09		10.0	6.1		2		2-6, 11-12, 14-15: (2)	**5**
44 00	07 20		10.0	6.2		3		2-6, 11-12, 14-15: (2)	**6**
38 08	14 48		9.0	5.6				2-6, 11-12, 14-15: (2)	**7**
41 48	15 16		11.0	6.3		5		2-5, 11-12, 15: (2), 14: (3)	**8**
40 49	14 26				4	3		2-5: (35), 11-12, 16: (1)	**9**
39 08	16 15		11.0	7.1				2-6, 11-12, 14: (7), 15: (2)	**10**
43 33	10 18		7.0	3.6		3		2-5, 11-12, 14-15: (2)	**11**
38 10	15 33		8.0					2-3, 11-12: (2), 14: (6)	**12**
44 04	12 34		9.0	5.7		2		2-6, 11-12, 14-15: (2)	**13**
37 20	15 10		8.5	6.0				2-5, 11-12, 14: (7), 15: (2)	**14**
37 25	15 10		11.0	6.8		4		2-5, 11-12, 14: (4), 15: (2)	**15**
40 49	14 26				3			2-5 (86), 11-12, 16: (1)	**16**
42 27	13 20		10.5					2-5, 11-12, 14: (3)	**17**
44 24	08 55		4.0	3.2				2-4, 11-12, 14-15: (2)	**18**
40 49	14 26				2			2-4: (86), 11-12, 16: (1)	**19**
38 06	13 22		9.0	5.8		2		2-4: (4), 11-12, 14-15: (2)	**20**
37 30	13 04		7.0					2-4, 11-12, 14-15: (2)	**21**
41 27	15 33		10.0	6.3				2-6, 11-12, 14-15: (2)	**22**
43 33	10 18		5.5	4.0		2		2-6, 11-12, 14-15: (2)	**23**
39 00	19 15		9.0	7.3				2-6, 11-12, 14-15: (7)	**24**
40 51	14 16		6.0	4.3				2-5, 11-12, 14-15: (2)	**25**
								2-4: (151)	**26**
38 18	15 58	13	11.0	7.0		3		2-6, 11-12, 14-15: (7), 13: (2)	**27**
38 15	15 43		9.5	6.3		6	9.0	2-6, 14-15: (7), 18: (8)	**28**
38 34	16 10	6	10.5	6.4				2-6, 11-12, 14-15: (7), 13: (2)	**29**
38 46	16 18		9.0	5.6				2-5, 11-12, 14-15: (7)	**30**
38 49	16 28		11.0	7.0				2-6, 11-12, 14-15: (7)	**31**
38 19	16 24		6.0	4.1				2-4, 11-12, 14-15: (2)	**32**
38 10	15 38		6.0	4.1				2-4, 11-12, 14-15: (2)	**33**
41 31	14 31		10.0	6.6		2		2-6, 11-12, 14-15: (7)	**34**
44 51	07 15		8.0	5.6				2-6, 11-12, 14-15: (7)	**35**

Code 1	YY 2	MM 3	dd 4	hh 5	mm 6	Subregion 7	Description 8	Rel 9	Cause 10
36	1813	5	17			Campania	Sea withdrawal in the Gulf of Naples	1	VA
37	1813	6	19			Campania	Sea withdrawal in the Gulf of Naples	1	VA
38	1817	1	14	14	30	Sicily Channel	Sea oscillations at Sciacca	0	EA
39	1818	2	20	18	15	Eastern Sicily	Anomalous sea waves at Catania	4	EA
40	1818	2	23	18	10	Liguria-Côte d'Azur	Violent sea waves at Antibes	2	EA
41	1818	12	9	18	52	Liguria-Côte d'Azur	Sea swelling in the harbour of Genoa	2	EA
42	1823	3	5	16	37	Northern Sicily	Boats carried and damaged by the sea (Cefalù)	4	ER
43	1828	10	9	2	20	Liguria-Côte d'Azur	Shipwrecks in the harbour of Genoa	4	EA
44	1832	3	8	18	30	Ionian Calabria	Sea flooding at Magliacane (Crotone)	4	EA
45	1836	4	25	00	20	Ionian Calabria	Strong sea retreat/flood. Boats damaged	4	EA
46	1846	8	14	12		Tuscany	1-yard sea rise in the harbour of Leghorn	4	EA
47	1847	8	26			Campania	5-feet sea level lowering in Naples	0	
48	1875	3	17	23	51	Central Adriatic	Sea retreat at Rimini, flooding at Cervia	4	ER
49	1885	1	16			Liguria-Côte d'Azur	Damage at Cannes, Nice and Oneglia	0	
50	1886	11	11			Liguria-Côte d'Azur	Damage at Cannes and Nice	0	
51	1886	12	17			Liguria-Côte d'Azur	Damage at Nice	0	
52	1887	2	23	5	21	Liguria-Côte d'Azur	Extended sea retreat. Some boats damaged	4	ER
53	1888	7	30			Liguria-Côte d'Azur	Two sea retreats at Pietra Lunga	2	
54	1889	12	8			Gargano	Sea agitation	2	ER
55	1894	11	16	17	52	Tyrrhenian Calabria	One vessel carried in land at Reggio	4	EA
56	1905	9	8	1	43	Tyrrhenian Calabria	Extended sea flooding. Boats carried in land	4	EA
57	1906	4	4			Campania	Sea oscillations in the Gulf of Naples	2	VA
58	1907	10	23	20	28	Ionian Calabria	Sea flooding at Capo Bruzzano	4	EA
59	1908	12	28	4	20	Messina Straits	Destructions and many victims in the Straits	4	ER
60	1916	7	3	23	21	Aeolian Islands	Sea level rise at Stromboli	4	EA
61	1919	5	22	17	45	Aeolian Islands	Sea flooding and boats carried in land	4	VO
62	1926	8	17	14	25	Aeolian Islands	Sea retreat at Salina	2	EA
63	1930	9	11	9	19	Aeolian Islands	Strong sea retreat and flooding at Stromboli	4	VO
64	1944	8	20	6	30	Aeolian Islands	Sea flooding. House destroyed at Stromboli	4	VO
65	1954	2				Aeolian Islands	Tsunami at Stromboli and seen in Sicily	4	VO
66	1968	4	18	19	38	Liguria-Côte d'Azur	Sea retreat and flooding at Alassio	4	ER
67	1979	10	16	13	57	Liguria-Côte d'Azur	3m high waves and flooding at Antibes	4	GS

Lat (N) 11	Lon (E) 12	Depth 13	Int 14	Mag 15	VEI 16	Tsu Int 17	Run-up 18	References 19	Code 1
40 49	14 26				2			2-4: (23), 11-12, 16: (1)	**36**
40 49	14 26				2			2-4: (23), 11-12, 16: (1)	**37**
37 30	13 00		7.0					2-6, 11-12, 14: (2)	**38**
37 34	15 07		9.5	6.2		2		2-6, 11-12, 14-15: (7)	**39**
43 45	08 00		8.0					2-6, 11-12, 14: (4)	**40**
44 46	15 54		7.0					2-6, 11-12, 14: (2)	**41**
38 00	13 57		8.0	5.9		4		2-6, 11-12, 14-15: (7)	**42**
44 43	09 00		8.0	5.7		2		2-6, 11-12, 14-15: (7)	**43**
39 00	17 00		10.0	6.7		2		2-6, 11-12, 14-15: (7)	**44**
39 34	16 43		9.0	6.2		3		2-6, 11-12, 14-15: (7)	**45**
43 31	10 32		9.0	5.6		3		2-5, 11-12, 14-15: (7)	**46**
								2-4: (23)	**47**
44 12	12 24		8.0	5.2		2		2-6, 11-12, 14-15: (2)	**48**
								2-4: (180)	**49**
								2-4: (180)	**50**
								2-4: (180)	**51**
43 53	08 00		10.0	6.4		3	1.5	2-6, 11-12, 14-15: (7), 18: (9)	**52**
								2-4: (39)	**53**
42 03	15 30		7.0					2-4, 11-12, 14: (2)	**54**
38 16	15 52		9.0	6.0		3		2-6, 11-12, 14: (7)	**55**
38 40	16 03		10.0	6.9		3	6.0	2-6, 11-12, 14-15: (7), 18: (10), (11)	**56**
40 49	14 26				3			2-4: (13), 11-12, 16: (1)	**57**
38 02	16 01		9.0	5.9		3		2-6, 11-12, 14-15: (7)	**58**
38 11	15 40		11.0	7.2		6	13.0	2-6, 11-12, 14-15, 18: (7)	**59**
38 48	15 12		7.0			3	10.0	2-6, 11-12, 14: (2)	**60**
38 48	15 12				3	3		2-6: (67), 11-12, 16: (1)	**61**
38 50	14 45		7.5					2-6, 11-12, 14: (2)	**62**
38 48	15 12				3	3	2.5	2-6: (46), 11-12, 16: (1)	**63**
38 48	15 12				2	4		2-6: (43), 11-12, 16: (1)	**64**
38 48	15 12				2	2		2-3: (42), 11-12, 16: (1)	**65**
44 05	08 00		5.0	3.6		2		2-6, 11-12, 14-15: (2)	**66**
43 42	07 15					3		2-6: (14), (15)	**67**