Affluence of data on Volcanism in the Gulf of Cadiz

Enrique Wulff-Barreiro
Marine Sciences Institute of Andalusia (CSIC)
Campus Universitario Rio San Pedro s/n.
11510 Puerto Real (Cádiz)
E-mail: enrique.wulff@icman.csic.es

This paper reports the recent progress on mud volcanism data accumulation in the case of the Gulf of Cadiz area. The discovery of giant mud volcanoes, deep coral reefs, and gas hydrates in 1999 and 2000, from the Guadalquivir Diapiric Ridge to the Larache Moroccan margin launched a dynamic of projects (GeNesis, MoundForce, MVSeis, HERMES) and international oceanographic campaigns (R/V Sonne, Marion-Dufresne, Logachev, Pelagia). The present monitoring of this Ibero-Moroccan oceanic zone is in absence of a comprehensive database available in one site to make the online search possible from a unique interface. The database might constitute a reference point for a focused scoped collection, aiming to modelize the contribution of data coming from the Istituto Hidrografico (Portugal), Instituto Geologico Minero (Spain), and the US and EU involvement. Interpreted profiles through recent programs both in the Alboran region and in the Gibraltar Arc System has permitted earth science data to be categorised into three folds: (1) collect and file geological data related with morphology and gas mobility; (2) collect data on rifting processes associated to seismicity and volcanism; and (3) provide geoinformation databases for the better understanding of the influence of neotectonic processes on coastal evolution. The need of a metadata exchange platform to chart the data on mud volcanism dischargeable from the research cruisers is outlined. An internet site creation grouping the diverse references, and allowing the file, encryption, and the data setting online will profit of the achievements of experiences like http://www-app1.gfz-potsdam.de/ghml/index.php. By identifying as a interactive topic the mud volcanism and gas hydrates. The author offers an overview of the archival and availability of all mud volcanism data gathered by research facilities in the Gulf of Cadiz. The current search for a detailed catalog of seismic images associated with hydrocarbon seeps in the Gulf of Cadiz considerably extrapolate the efficiency of mud volcanism by covering 3.050 km of multichannel seismic. The volume of fluid extruding with the mud is variable, but reaches up to 15 km^3 fluid per km trench length and Ma along cross sections. The number of mud volcanoes in the three regions (Moroccan, Portuguese, and Spanish) are nowadays inactive.

A PRELIMINARY INTRODUCTION.-

Gas-charged sediments regional data revealed a series of mud volcanoes in the Gulf of Cádiz, SW Spain [Ercilla G & Baraza J, 1996][1]. The gas hydrate content in sediments recovered from the deepest water depths, 2200 m – 3060 m, is 3-16% of the sediment volume and 5-31% of the pore space volume [Mazurenko LL et al., 2002][2]. Previous data derived from this search for deep gas, methane caged in icy hydrates, have been estimated by inclosing the distribution of these structures in three areas the Morocco margin, the Deep Portuguese margin and the Iberian margin [Somoza L et al., 2003][3] [Díaz del Río V et al., 2003][4]. In the Iberian margin have been differentiated two main fields : one in the surroundings of the Guadalquivir Diapiric System (GDS) and the other in the Central Slope namely the Tasyo Area. Also manganese nodules have discovered located at the base and flanks of mud-carbonate mounds and mud volcanoes in the Guadalquivir Diapiric Ridge Area [González FJ et al., 2008][5].

To write a schema that essentially allows to describe the data coming from the mud volcanoes the literature discusses their distribution, explains the mechanisms by which they form, and characterize associates hydrates accumulations. It is important to express that a submarine mud volcano is considered as an edifice which have been built up by the eruption of mud breccia triggered by the vertical migration of hydrocarbon-rich fluids [Somoza L et al., 2003][6]. The elaboration of an universal lithological and genetic classification of recent mud volcanic deposits appears to be an interesting research target related to further scientific needs [Akhmanov et al., 2001][7]. Indeed if the present monitoring of this Ibero-Moroccan oceanic zone is in absence of a comprehensive database it is due to the fact that none of the classification schemes proposed for mud volcanic deposits is universal. All of them have rational and reasonable arguments. But only an universal classification can be taken as a basis for compiling a database of mud volcanic deposits.

---

[1] Ercilla, G. & Baraza, J. , (1996).- Evidencias de gas en los sedimentos del talud del Golfo de Cádiz. *Geogaceta*

[2] Mazurenko LL, Soloviev VA, Belenkaya I, Ivanov MK & Pinheiro LM. Oct, 2002.- Mud volcano gas hydrates in the Gulf of Cadiz. Terra nova, 14, 5, 321-329., vol.20 (2): 164-166.

[3] Somoza L, Diaz-del-Rio V, Leon R, Ivanov M, Fernandez-Puga MC, Gardner JM, Hernandez-Molina FJ, Pinheiro LM, Rodero J, Lobato A, Maestro A, Vazquez JT, Medialdea T & Fernandez-Salas LM. Mar 30, 2003.- Seabed morphology and hydrocarbon seepage in the Gulf of Cadiz mud volcano area: Acoustic imagery, multibeam and ultra-high resolution seismic data. Marine geology, 195, 1-4, 153-176.

[4] Diaz-del-Rio V, Somoza L, Martinez-Frias J, Mata MP, Delgado A, Hernandez-Molina FJ, Lunar R, Martin-Rubi JA, Maestro A, Fernandez-Puga MC, Leon R, Llave E, Medialdea T & Vazquez JT. Mar 30, 2003.- Vast fields of hydrocarbon-derived carbonate chimneys related to the accretionary wedge/olistostrome of the Gulf of Cadiz. Marine geology, 195, 1-4, 177-200.

[5] González FJ, Somoza L, Lunar, R, Martínez-Frías J, Martín Rubí JA, Torres T, Ortíz JE, León R, Medialdea T, Díaz del Río . 2008. Ferromanganese nodules in the Gulf of Cadiz: The hydrocarbon seepages and the Mediterranean Outflow Water undercurrent as mineralization controls. In: International Geological Congress, Oslo.

[6] vid. nt.3

[7] Akhmanov GG, Ivanov MK, Woodside JM & Cita MB. Jan 28-Feb 2, 2001.- Lithology of deep-sea mud volcanic deposits: general assessment of current knowledge and future research needs. In: Akhmanov G. & Suzyumov A. Geological processes on deep-water European margins : International conference and Ninth post-cruise meeting of the training-through-research programme : Moscow, Russia, 28 January-2 February 2001. IOC Workshop report, 175.

Regarding the existing identification schemes for the mud volcanoes some of the more recent paid attention to different granulometric parameters [Kroupskaia et al., 2001][8]. Others recognize main tipology on the base of microstructural and microtextural characteristics of mud breccia [Akhmanov & Woodside, 1998][9], so attributing to different depositional processes each lithological type of mud volcanic deposit. In addition, based on the primary observations on core, mud breccie types were defined as pebby muds, polymictic gravels, or matrix-supported mud debris flow deposits. An excess of generalization in the explanation of differences in lithology, and the classification themselves not been detailed enough have determined the absence of convergence to an universal classification.

A catalogue to report a field of mud volcanoes in the Gulf of Cadiz must consider some 40 buildings, that have been identified by BSR (Bottom Simulating Reflector)-like reflections [Moundforce, 2007]. The name, latitude, longitude, water depth, length, width, area, and diameter constitute the elemental units of identification corresponding to the individual edifices. The size, shape, seismic artifacts, faulting and relation to the underlying structure, collapse structure, and mud flows and timing of activity is the information that we consider necessary in order to have a good and accurate characterization.

Geochemical analyses of mud volcanoes gases from gas-hydrate aggregates consist of: the water samples location, date and identification, the isotopic analysis of the water by using mass spectrometry, and the chromatography of the gases after sediment extracted by means of ionization detectors. A structured representation of the geochemical data comprises estimations on gas emission during periods of quiescence, and during violent eruptions, methane concentrations, etc.

This contribution is organized with a first bibliometrics description of the Gulf of Cadiz mud volcanoes database that consists of XXX references over a period of 25 years. In a second step, by using all the literature data available, it follows an exposition on which way the data could be sorted to get a classification. Its objective is to offer an overview of the archival and availability of all mud volcanism data gathered by research facilities in the Gulf of Cádiz.

BIBLIOMETRICS : Journal coverage, Author productivity, Core literature.

Providing a good starting point for data exploration is presented here as represented by the analysis of such basic entities as authors' productivity and citations. That is what bibliometrics' involves from the quantitative analysis of the literature side. [Kurtz et al., 2003]. [10] An information facility like a comprehensive database, or a data

[8] Kroupskaia VV, Andreeva IA, Sergeeva EI, Cherkashev TT, Vogt PR & Ivanov MK. 2001.- The Haakon Mosby mud volcano (Norwegian sea): peculiarities of composition and structure of the deposits. Processing of the congress Arctice-99. Moscow. Nauka.

[9] Akhmanov GG & Woodside JM. 1998.- Mud volcanic samples in the context of the Mediterranean ridge mud diapiric belt. In: Robertson AHF, Emeis KC, Richter C & Camerlenghi A (Eds.), Proc. ODP, Sci. Results, 160: College Station, TX (Ocean Drilling Program), pp. 597-605.

[10] Kurtz MJ, Eichhorn G, Accomazzi A, Grant CS, Demleitner M, Murray SS, Martimbeau N & Elwell B. 2003.- The NASA Astrophysics Data System: Sociology, Bibliometrics, and Impact. http://cfa-www.harvard.edu/~kurtz/jasist-submitted.pdf

repository, would benefit if its contents are described statistically. It will simplify data harvesting and provide ready visualisation of data.

Journal coverage.
The recent appearance of mud volcanism data gathered by research facilities in the Gulf of Cadiz can be viewed from the Table 1 that lists the postings frequencies for searches for the four descriptors, 'mud volcano', 'volcanism', 'methane' and 'chimney' all in a conjunctive boolean equation with the geographic name 'Gulf of Cadiz'.

Term	*Google*	*Google Scholar*	*Web of Knowledge*	*Scopus*
Mud volcano	1710	207	23	414
Volcanism	15100	504	8	422
Methane	9360	319	19	861
Chimney	544	47	1	64

Table 1. Occurrences of search terms in *Google*, *Google Scholar*, the *Web of Knowledge* and *Scopus*

Conceptually these data can be viewed from the perspective of volume. Its restricted temporal evolution, from 1999 when the first data began to appear from the mud volcanoes explorations in the Gulf of Cadiz, limits the effect of team consolidation on research collaboration and performance of scientists [Martín-Sempere et al., 2002][11]

In this table the *Google* occurrence-frequencies show that while the subject of significant study can be directly selected, as the highest rates expressed 'Volcanism', the descriptor space can be gridded in the second place by the relative popular fate that appears to have the search for submarine 'Methane'. The Google Scholar data set is based on a similar qualitative justification. Scopus clearly deserves prior attention to the data entries that translate the interest into 'Methane'. Undoubtedly the bathyal ecosystems associated with carbonate chimneys are clearly a most probable source of data consistent with leading ranked information. The number of mud volcanoes discovered are more often quoted inside the Web of Knowledge. May be because many academics are obliged to document their citations for merit-based considerations [Redner S, 1998].[12]

Articles on mud volcanoes, volcanism, methane, chimney in the Gulf may do not contain these particular words, but clearly they are crucial as factors at play to focus on relevant data when considering its online availability and for download. A search of all the fields in the Scopus database retrieved 208 citation sources, with 23 literature sources yielding a minimum of three documents as shown in Table 2.

[11] Martín-Sempere Mª. J., Rey-Rocha J., Garzón-García B. 2002. The effect of team consolidation on research collaboration and performance of scientists. Case study of Spanish university researchers in Geology. Scientometrics, 55, 3, 377-394.
[12] Redner S. 1998. How popular is your paper? An empirical study of the citation distribution. http://arxiv.org/abs/cond-mat/9804163v1

Citation source	Number of documents
Marine Geology	26
Geo-Marine Letters	17
Earth and Planetary Science Letters	7
Marine and Petroleum Geology	7
Terra Nova	7
Sedimentary Geology	6
Tectonophysics	5
Geological Society Special Publication	5
Journal of Geophysical Research B Solid Earth	5
Organic Geochemistry	4
Tectonics	4
Marine Geophysical Researches	4
Comptes Rendus Geoscience	4
Continental Shelf Research	4
Geophysical Journal International	4
Geochimica Et Cosmochimica Acta	3
Geofluids	3
Journal of Marine Systems	3
Journal of the Geological Society	3
Scientia Marina	3
Sedimentology	3
Zootaxa	3
Deep Sea Research Part II. Topical Studies in Oceanography	3

Table 2. Most commonly occurred literature sources in a search of the *Scopus* for mud volcano, volcanism, methane, chimney, in the Gulf of Cádiz.

Of these documents, almost all were journal articles (181). Conference papers were just fifteen and except for the OCEANS 2007 – Europe meeting and the 2001 Proceedings of the International Offshore and Polar Engineering Conference, all were published as journal papers. The list is dominated by *Marine Geology* thus confirming its most common use as a core journal for the subject. That apart the list contains 18 extensively-based geological journals, with the remainder been three journals covering general topics in oceanography (*Scientia marina*, *Journal of Marine Systems* and *Deep Sea Research Part II. Topical Studies in Oceanography*), and one specialist journal covering topics that are enclosed in the area of taxonomy (*Zootaxa*). The 10 Review articles appear in four geological journals, one inside a multi-disciplinary journal (*Science*), and four into journals that publish relevant material sought under the queries on oceanography, climate, taxonomy and physics (*Oceanography and Marine Biology*, *Palaeogeography Palaeoclimatology Palaeoecology*, *Physica D Nonlinear Phenomena* and *Zootaxa*). Citations from 96 journals were responsible in 1999-2008 of the citations to the core journal of *Marine Geology*. These including *Geo Marine Letters*, *International Journal of Earth Sciences* or *Marine Geophysical Researches* (and, in the first place, *Marine Geology* itself). And the 161 used by *Marine Geology* in the same period include *Geo Marine Letters*, *Geology* and *Technophysics* (with in the first place *Marine Geology* itself). This journal data for citations to and references from *Marine*

Geology shows that in spite of the brief temporal period this is a topic in its own right inherently implying one specific subject (geology).

Author productivity.

In Table 2 have been considered the journals having in focus the topic 'mud volcano in the Gulf of Cádiz'. But an author analysis aware of the importance of the subject will show its most productive researchers. The results of such analysis are shown in Table 3. For each journal in Table 3, we have listed the 10 most productive authors in the period, using the 'Limit to' routines in *Scopus*. Each column contains an author name and the number of papers published in brackets under the names of the first ten specialist journals as identified in Table 2.

Marine Geology (26)	Geo Marine Letters (17)	Earth and Planetary Science Letters (7)	Marine and Petroleum Geology (7)	Terra Nova (7)	Sedimentary Geology (6)	Geological Society Special Publication (5)	Journal of Geophysical Research B Solid Earth (5)
Somoza, L. (5)	Fernandez-Puga, M.C. (3)	van den Bogaard, P. (1)	Lunar, R. (1)	Arboleya, M.L. (3)	Wilson, K. (1)	Ziegler, P.A. (1)	de Lamotte, D.F. (1)
Ivanov, M. (4)	Mata, M.P. (3)	Yun, T.S. (1)	Martinez-Frias, J. (1)	Teixell, A. (3)	Swennen, R. (1)	Woodside, J.M. (1)	Zeyen, H. (1)
Fernandez-Puga, M.C. (4)	Garcia-Gil, S. (3)	Wallmann, K. (1)	Mazzini, A. (1)	Mauffret, A. (1)	Smith, H.D. (1)	Viana, A.R. (1)	Van Rensbergen, P. (1)
Maestro, A. (4)	Somoza, L. (3)	Voelker, A.H.L. (1)	Merinero, R. (1)	Mazurenko, L.L. (1)	Piola, G. (1)	Sultan, N. (1)	Tassara, A. (1)
Medialdea, T. (3)	Medialdea, T. (2)	Verges, J. (1)	Morales-Puente, P. (1)	Medialdea, T. (1)	Ori, G.G. (1)	Stow, D.A.V. (1)	Seeber, L. (1)
Vazquez, J.T. (3)	Mulder, T. (2)	Tiberi, C. (1)	Mortera-Gutierrez, C. (1)	Missenard, Y. (1)	Morz, T. (1)	Somoza, L. (1)	Sebrier, M. (1)
Hernandez-Molina, F.J. (3)	Hanquiez, V. (2)	Schonfeld, J. (1)	Nermoen, A. (1)	Pinheiro, L.M. (1)	McKirdy, D.M. (1)	Roure, F. (1)	Schmidt, S. (1)
Henriet, J.P. (3)	Vazquez, J.T. (2)	Santamarina, J.C. (1)	O'Brien, P.E. (1)	Reiners, P.W. (1)	Little, T. (1)	Nunes, M.C.V. (1)	Saddiqi, O. (1)
Hovland, M. (2)	Leon, R. (2)	Ruppel, C. (1)	Planke, S. (1)	Ruiz, G. (1)	Kreiter, S. (1)	Lopez, M. (1)	Ryan, W.B.F. (1)
Ivanov, M.K. (2)	Mazurenko, L.L. (1)	Reitz, A. (1)	Prol-Ledesma, R.M. (1)	Saddiqi, O. (1)	Kopf, A. (1)	Llave, E. (1)	Poort, J. (1)

Tectonophysics (5)	Organic Geochemistry (4)
Fernandez, M. (2)	Sinninghe Damste, J.S. (2)
Zeyen, H. (1)	Elvert, M. (2)
Verges, J. (1)	Stadnitskaia, A. (2)
Torne, M. (1)	Baas, M. (1)
Thiebot, E. (1)	Blinova, V. (1)
Teson, E. (1)	Bouloubassi, I. (1)
Teixell, A. (1)	Hinrichs, K.U. (1)
Marzan, I. (1)	Hopmans, E. (1)
Julivert, M. (1)	Ivanov, M.K. (1)
Jenner, G.A. (1)	Milkov, A.V. (1)

Table 3. Most productive authors in the first ten specialist journals identified in Table 2. The number that follows each journal (or author), into brackets, name is the number of documents published on 'Mud volcanoes in the Gulf of Cádiz' in that journal or by this author in the period 1999-2008.

The examination of the most productive authors that publish across the range of the journals indicate that three of them publish in three journals, Somoza, Medialdea and Fernández-Puga.

These are the journals *Marine Geology*, *Geo Marine Letters* that the three share, and *Geological Society Special Publication*, *Terra Nova* and *Tectonophysics* where the authors publish independently. So user-oriented initiatives looking for data must retain the role these five journals have in terms of author productivity. Of considerable interest might be that with the textual data item 'methane' the most productive author is Gómez Parra.

A considerable degree of overlap between the journals occurs when exploring the four searching results. The context of interdisciplinarity resides then in the journals Marine Geology (12 occurrences in the four searches), Geo Marine Letters (7), Terra Nova (5), Tectonophysics (5), Earth and Planetary Science Letters (5), Tectonics (4). Concerned with the percentual usage of reference to give us the idea on the relevant classification of the original data in terms of author productivity, the 9210 References that are cited by the 208 selected documents were estimated. Somoza the best example of performance with 57% of the quota shown by the ten most used authors, as measured by the employ of their articles in the lists of references of other authors.

Core literature.
The most cited articles open a new data collection. To report these features the observations are collected in Table 4.

Highly cited articles	Citations
Maldonado, A. et al. (1999), "The Betic orogen and the Iberian-African boundary in the Gulf of Cadiz: Geological evolution (central North Atlantic)", *Marine Geology*, Vol. 155 (1-2), pp. 9-43.	66
De Mol, B. et al. (2002), "Large deep-water coral banks in the Porcupine Basin, southwest of Ireland", *Marine Geology*, Vol. 188 (1-2), pp. 193-231.	60
Duggen, S. et al. (2004), "Magmatic evolution of the Alboran region: The role of subduction in forming the western Mediterranean and causing the Messinian Salinity Crisis", *Earth and Planetary Science Letters*, Vol. 218 (1-2), pp. 91 -108.	43
Pinheiro, L.M. et al. (2003), "Mud volcanism in the Gulf of Cadiz: Results from the TTR-10 cruise", *Marine Geology*, Vol. 195 (1-4), pp. 131-151.	43
Díaz del Río, V. et al. (2003), "Vast fields of hydrocarbon-derived carbonate chimneys related to the accretionary wedge/olistostrome of the Gulf of Cádiz", *Marine Geology*, Vol. 195 (1-4), pp. 177-200.	38
Somoza, L. et al. (2003), "Seabed morphology and hydrocarbon seepage in the Gulf of Cádiz mud volcano area: Acoustic imagery, multibeam and ultra-high resolution seismic data", *Marine Geology*, Vol. 195 (1-4), pp. 153-176.	36
Fleischer, P. et al. (2001), "Distribution of free gas in marine sediments: A global overview", *Geo-Marine Letters*, Vol. 21 (2), pp. 103-122.	33
Woodside, J.M. et al. (1998), "Shallow gas and gas hydrates in the Anaximander Mountains region, eastern Mediterranean Sea", *Geological Society Special Publication*, (137), pp. 177-193.	30
Medialdea, T. et al. (2004), "Structure and evolution of the "Olistostrome" complex of the Gibraltar Arc in the Gulf of Cádiz (eastern Central Atlantic): Evidence from two long seismic cross-sections", *Marine Geology*, Vol. 209 (1-4), pp. 173-198.	25
Milkov, A.V. (2005), "Molecular and stable isotope compositions of natural gas hydrates: A revised global dataset and basic interpretations in the context of geological settings", *Organic Geochemistry*, Vol. 36 (5), pp. 681-702.	23
Gay, A. et al. (2003), "Sinuous pockmark belt as indicator of a shallow buried turbiditic channel on the lower slope of the Congo basin, West African margin", Geological Society Special Publication, Vol. 216, pp. 173-189.	22
Kvenvolden, K.A., Rogers, B.W. (2005), "Gaia's breath - Global methane	20

exhalations", *Marine and Petroleum Geology*, Vol. 22 (4 Spec. Iss.), pp. 579 -590.	
Cole, D. et al. (2000), "Giant irregular pockmark craters in the Palaeogene of the outer Moray Firth Basin, UK North Sea", *Marine and Petroleum Geology*, Vol. 17 (5), pp. 563-577.	20
Judd, A.G. (2003), "The global importance and context of methane escape from the seabed", *Geo-Marine Letters*, Vol. 23 (3-4), pp. 147-154.	19
Van Rensbergen, P. et al. (2005), "The El Arraiche mud volcano field at the Moroccan Atlantic slope, Gulf of Cadiz ", *Marine Geology*, Vol. 219 (1), pp. 1-17.	18

Table 4. Most cited articles in 10 top journals (those in Table 3) in 1996-2008.

Ranked in decreasing order of citations these are the first fifteen documents to appraise the data to index as it they were to be enclosed into the inner space of a database. Data such as that must to be linked to the total number of citations (1940) attracted by the complete set of documents cited (208). As the exploration of the sea mud volcanoes is notably technology-dependent the code to dimension the mean number of citations by document is not strangely low. Attaining just a mean value of 24 for the complete set, and of 16 after choice only of the first ten journals (like in Table 4).

The result is that none of the articles listed in Table 4 offers criterion, from their titles, on the use of databases or software packages for the automatic data map. The American Geophysical Union policy by reducing free access to their corporate data could explain this. If a characteristic of this investigation is the use of radiocarbon age calibration, fluctuating sea levels estimations, testing, numerical and statistical models the analysis must “shrinking away” from the dimension of the citations to observe these descriptors. The absence of review articles is also interesting, as the research profiling by reviewing the literature is an expression of the databases’ existence.

Most of these articles will be familiar to workers in the Gulf of Cadiz mud volcanoes field, whatever their particular specialism. They are necessary because in this way by extracting the data inserted in them an estimate of the total occupied volume of a database to design is prevented from inflating.

DATABASE.: Visualization, Mud volcanoes classification.

Free access to mud volcanism and deep gas hydrate data coming from the Gulf of Cadiz requires a database service. Acceptable ranges of observed variables as a function of depth by basin includes volcano names (synonyms and subsidiary features), mud volcanoes types and morphologies/structures, latitude and longitude, water depth, mud volcanoes’ elevation, crater, slope and moat, sedimentary structure, fauna collected in the mud volcanoes, mud volcanoes’ images; composition of the gas hydrates, range of emitted methane, isotopic analysis of oxygen and hydrogen; and data sources (sample references and bibliographic samples).

A good model to design a data exchange platform could be based on a data input form as prepared by the CODATA gas hydrate data task group. It should be organized by distributing an initial recommendation on data management based in three alternative methods: the entrance of the data by hand, as an entire data file, or as data sets from a

database. All options must fit to a procedure in two steps : the meta data and the data values entrances. To publish it on the web or an intranet the metadata entry comprises:

the selection of the information for the depending measurements:
depending measurement (depth, time);
unit of depending measurement (meter, feet);
position of depending measurement (onshore, offshore).
the selection of the measurement parameters and their unit:
gas mass spectrometer data;
gas chromatograph data
additional information:
number of data rows

The basic scheme definition should be extended with additional data fields to customize it to different needs. It must be considered, eg, how to add electron microscopy data (images and chemical spectra) to a certain mud volcano gas flux emission [Reiter E, 2007][13].

Database visualization.
After clicking on the database web the first time user will be prompted to log in. By entering an ID and password and clicking on, the opening page will display the news and links to database information simply by interfacing with information hosted. A drop down menu will show the types of searches that can be done:

Bibliographic search form
Mud volcano data search form
Reduced mud volcano search form
Gas hydrate (formula) search form
Database entry lookup search form
Comprehensive search form

For instance, the database lookup entry would provide an option to choice which database is to be searched where all field names are to be highlighted in order to get help on searching that field. An option to switch between forms should be available from the drop down menu.

The representations obtained by the comprehensive option contain fields from all the other 5 forms. A search could be calculated for bibliographic data, mud volcano data or gas hydrate data. By clicking on the highlighted texts information on the fields should appear. The user would search for a specific field or all by entering the query in the boxes, for example a simple name and journal name. A surname could be typed in that could be combined with other author name by using logical operators. A journal name could be searched for by introducing its first letters. The option is to be launched by using the search button. To select the correct journal name a list would be provided from a drop down menu. The query could be saved and the number of hits per page and

[13] Reiter E. 2007. Volcanogasml: a format to exchange geochemical volcanic gases data. Data Science Journal, 6, 21 January 2007, 18 pp.

how much data is to be displayed (bibliographic, mud volcano or gas hydrate data) are to be specified.

Within the hit display form should be shown the mud volcano name and data, the gas flux rates, and the reference data information with buttons to download and display data. For example, if after a number of hits the list of references is required by clicking on the printable option a new window appears with a list of references that can be printed off.

3D images from multibeam bathymetry showing the different types of mud volcanoes morphologies related to hydrocarbons could be displayed by using the display mud volcanoes classification structure option. Plug-ins and java applets are to be provided from the own web site. A new window would open showing the 3D images. It would be possible to rotate the image by dragging the mouse. By right clicking a menu is brought up that would make available a number of options such as changing the display as to provide shaded illumination maps of the sea floor at the mud volcano field, single-channel sparker lines across the mud volcanoes or side scan sonar images of the mud volcanoes. By holding the shift key and dragging the mouse down the size of the image is increased or by dragging is up the size is decreased. To display a methane-related carbonate chimney a special option is to be designed. By choosing image or taxonomical plots a new display mode is generated. Bottom camera photographs showing carbonate chimneys, and ice-like gas hydrates crystals recovered would be showed. Otherwise a listing of the macrofauna taxa recovered from each gravity core and from the grab sample of the sieved sediments in the mud volcanoes is showed

Alternatively an option to switch to the gas emission structure is to be provided. Data could be downloaded on a number of different rates. From the drop down menu could be selected the gas sample contents study, the chemical and isotopic measurements for the water samples, or an overview of indicators providing maximum methane concentration and interpretation. Also a selection of file formats and which computer platform to use are to be offered.

All the bibliographic references should be SFX by Ex Libris linked to the electronic versions. By clicking on the link and entering the ID and password (the first time the user would be asked to do it) the electronic article is to be found. If the article is available from a open access repository or the research centre or university from where the user would consult is subscribed to the journal the full article would be viewed either in html or pdf format.

Mud volcanoes classification.

How is it envisaged the required mud volcanoes classification? As an universal classification does not exists an excessive quality control data can not be secured [Akhmanov et al., 2001][14]. Lineage statements are local and problems on classification are explicitly considered only in a case [León, R. et al., 2006][15]. This is an inherent limit on the database design efficiency. Whatever the design strategy and network access

[14] vid nt. 9.

[15] León R., Somoza L., Medialdea T., Maestro A., Diaz-del-Río V., Fernández-Puga Mª C. 2006. Classification of sea-floor features associated with methane seeps along the Gulf of Cadiz continental margin. Deep-Sea Research, Vol. 11, 53, pp. 1464-1481.

configuration, remember to validate the overall design from the user's perspective depends on the goals of interoperability. The database is to leave a legacy of infrastructure within the control of the scientists, a specific audience with specific tasks in mind.