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A Review of the Stratigraphic Code of Pakistan

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Abstract: In the present article the Stratigraphic Code of Pakistan has been reviewed. The exercise originates the opinion that the Code is incomplete and it ought to have been revised. The apparent insufficiencies of remarks on a number of stratigraphic units remaining in the Code are discussed. The categories of stratigraphic units, the Code not dealt with are defined due to their defensible scope and applicability.

Keywords: Stratigraphic Code, Stratigraphic Units, Stratigraphy

1. INTRODUCTION

Stratigraphy is the fundamental branch of geology which deals with the spatial distribution and chronological classification of rocks. A stratigrapher deciphers in the rock record to find events occurred in the animate and inanimate creature throughout the geologic time and utilizes these events to organize the rock record in the form of several kinds of stratigraphic units which ultimately forms the basis for the construction of relative geological time scale facilitating the history of the earth and its inhabitants with a time framework and for understanding the laws now governing its organic and inorganic productions more comprehensively. (Lyell, 1852, 1853; Dana, 1880; Grabau, 1913; Dunbar and Rodger, 1957; Hedberg, 1976; Salvador 1994; Gradstein *et al.,* 2004; Vai, 2007; Ogg *et al.,* 2008; and many other).

In view of achieving the ultimate goal of stratigraphy, the practice above alluded to, involves correlation on a global scale, and hence demands uniformity in concepts among stratigraphers. *"Without correlation, successions in time derived in one area are unique and contribute nothing to understanding Earth history elsewhere."* (McLaren, 1978 cited Ogg. *et al.,* 2008).

For the sake of standardizing, and achieving the uniformity in concepts about principles of stratigraphic classification, procedure and terminology, many countries including Pakistan have had prepared their stratigraphic codes. A stratigraphic code is a set of authoritative regulations which governs the research in stratigraphy (Shah, 2009). The International Sub-Commission on Stratigraphic Classification (ISSC) of International Union of Geological Sciences (IUGS) nternational Commission on Stratigraphy (ICS) is intended to promote the world wide agreement on principles of stratigraphic classification, procedure and terminology; and welcomes these codes as suggestions to develop what in the interest. However, a worldwide acceptable stratigraphic code has not been established yet. So, Murphy and Salvador (1999) in their abridged version of International Stratigraphic Guide stated "Like the second edition of the *International Stratigraphic Guide*, this abridged version is offered as a recommended approach to stratigraphic classification, terminology, and procedure, nor as a *code*" [the word code with inverted comma modified as italics]

Stratigraphic Code of Pakistan was prepared by the Stratigraphic Nomenclature Committee of Pakistan (SNCP) and appeared in 1962. It is constituted of principles of stratigraphic classification, five recognized categories of stratigraphic units and defined stratigraphic units within each category as well as important

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terminology. Since 1962, although the publication of International Stratigraphic Guide (Hedberg, 1976; Salvador, 1994) and many other papers on the subject made evident the incompleteness of the Code, it had neither been reviewed nor updated, anyhow, Code's inadequateness notwithstanding. Keeping in consideration: the recent advancements in stratigraphy such as *sequence stratigraphy*, *magnetostratigraphy*, *chemostratigraphy*, their significance in understanding the evolution of the earth face and in calibration of geological time scale; the formal recognition of some new categories of stratigraphic units in International Stratigraphic Guide and many other Stratigraphic Codes of different countries followed by these advancements—the opinion originates that the stratigraphic Code of Pakistan is inadequate and it ought to be updated.

2. MATERIAL AND METHODS

2. Summary of Stratigraphic Code of Pakistan (1962)

As the growing necessity of standardizing stratigraphic nomenclature in Pakistan was felt, the Stratigraphic Nomenclature Committee of Pakistan was set up consisting of members mostly from the Oil Companies and from the Geological Survey of Pakistan on the proposal of the Director, Geological Survey of Pakistan in a meeting of representatives of Geological organizations in the country convened by him on 20th January, 1960. It was decided that the committee would examine various stratigraphic codes in practice in different parts of the world at the time to find out the suitability of their application in Pakistan. During 1960, the Committee held numerous meetings to discuss various aspects of the problem and in the meeting of the Committee in January 1961; the Code was finally approved and appeared in 1962. Five categories lithostratigraphic, biostratigraphic, ecostratigraphic, chronostratigraphic and geochronologic units were recognized in the code and the units within each of these categories were defined following the recommendations of American and Australian Commissions on Stratigraphic Nomenclature and particularly of International Sub-Commission on Stratigraphic Terminology (Day in Rehman 1962). A summary of Stratigraphic Code of Pakistan is given in **(Tab. 1)**.

The following text in the Section 2 has been perceived from the Stratigraphic Code of Pakistan (Rehman 1962); but not at all which will be written under the heading of *Remarks* and *Discussion*. The remarks on lithostratigraphic and biostratigraphic units are paraphrased from North American Commission on Stratigraphic Nomenclature (NACSN) (2005) and Salvador (1994) which the author feels most appealing and applicable to stratigraphy of Pakistan.

(Tab.1). Summary of Stratigraphic Code of Pakistan. Five categories of stratigraphic units which have been recognized in the Code are: lithostratigraphic units; biostratigraphic units; ecostratigraphic units; chronostratigraphic units; and geochronologic units. Two general terms, *facies* and *zone* included in this category have been defined in an informal sense.

Category	Basis	Units recommended in the code
Litho-stratigraphic Units	Lithology	Supergroup Group Formation Member Bed(s)
Biostratigraphic Units	Fossil contents	Acrozone Epibole Cenozone
Ecostratigraphic Units	Environment of origin	Facies
Chrono-stratigraphic Units (Time-Rock units)	Geologic age of the rocks	Supersysten Systen Series Stage Sub-stage
Geochronologic Units (Time units)	Geologic Time	Era Period Epoch Age
General Terms	Any specified basis	Facies Zone

2.1. Lithostratigraphic Units

A lithostratigraphic unit is a body of strata which can be distinguished from its overlying and underlying bodies of rocks on the basis of lithology. The lateral and vertical boundaries of lithostratigraphic units should be designated on the basis of significant change in lithological characters. Lithostratigraphic units are independent from time connotation; however, the age of the lithostratigraphic unit may influence the choice of the boundary.

The units defined in this category in the Code in ascending order of their rank are *bed; member*, *formation*, *group*, and *Supergroup*. A *formation* is the fundamental and the only formal lithostratigraphic unit which is used for dividing the whole stratigraphic column into named lithostratigraphic units; while the other units may be described with relation to the formation.

The name of a lithostratigraphic unit is binomial, derived from appropriate geographic feature of the type area combined with the word

formation or where possible with dominant rock type e.g. Patala Formation, Skaser limestone.

Remarks: (a) The word lithology has been derived from the Greek *lithos*, stone, rock and *logos*, a discourse, so lithology means knowledge of describing rocks. The term lithology has been frequently used by geologist in two different senses. In a formal sense the lithology of a rock means the description of that very rock in a hand specimen or in an outcrop. The descriptive properties of a rock includes color, texture, structure, composition, fabric, fossils size and shape if present etc. In an informal sense, it is used for a single property of rock e.g. limestone, shale etc.

(b) A lithostratigraphic unit may be composed of (wholly or partially) consolidated, compact, rocky material or unconsolidated soils.

(c) The lithological change across the vertical boundaries of two lithostratigraphic units may be abrupt, or gradational. Progressive gradational and intercalated are two types recognized in the gradational kind. The boundary is usually placed arbitrarily in the zone of gradation. The lateral boundaries may be gradational or intertonguing.

(d) A lithostratigraphic unit may constitute an unconformity within it or its upper boundary or lower boundary or both may be unconformities.

(e) A lithostratigraphic unit may constitute volcanic flows intercalated with sedimentary rocks, or may wholly composed of volcanic or slightly metamorphic rocks provided that it obeys the law of superposition. (See section 3.5 also)

(f) A formation can be divided into members, or formations may be combined into a group provided the practical advantages of the proposal justified.

(g) The geomorphological expression may play role in identification of the lithostratigraphic unit in the field during mapping.

(h) The word "Zone" may informally be used as a lithostratigraphic unit such as "coal zone", "fossiliferous zone", "mineralized zone", etc.

Discussion: What to do if someone argues that the designated type section of a formation is inadequate? This may be clarified by the following example. Let's suppose, someone propose the name Y formation for X formation by making objection on the designated type section of the later i.e. the lower contact of the X Formation with the underlying Z Formation is faulted, besides there is no privilege of lithological characters of the designated type section in others areas of its distribution; so the name of the X formation should be replaced by Y Formation; as the section exposed in the geographic area Y (from which the new proposed name is derived) fulfill all the requisites of a type section.

For the moment, his objection on the earlier designated type section is valid but his proposal to change the name of the formation is not acceptable. A new name for a lithostratigraphic unit adds nothing to our knowledge but increase a synonym in the stratigraphic literature.

As the name of lithostratigraphic unit is binomial, derived from appropriate geographic feature of the type area combined with the word formation or where possible with dominant rock type, therefore, the type section can never be changed to avoid a synonym. However, if a designated type section has been proved inadequate once, it may be supplemented with a principle reference section. (See NACSC, 2005 and reference therein).

2.2. Biostratigraphic Units

Biostratigraphic units are bodies of strata divided and identified on the basis of their fossil content. Fossils alone provide excellent data for the chronological classification of rocks. The units defined in this category are, *Acrozone, Epibole,* and C*enozone.* For definitions see fig. 1.

Discussion: There are various kinds of biozone; which are defined utilizing the first and last occurrences of the fossil taxa. Only three kinds have been recognized in this category in the Code are, *Acrozone (taxon range biozone), Epibole (acme biozone or abundance biozone),* and *cenozone (assemblage biozone)*. The other kinds of biozone which are not treated in the Code are very helpful in high resolution biostratigraphy includes, *interval biozone, lineage biozone and concurrent range biozone*. Besides, these kinds of biozone are utilized in many world-wide acceptable biostratigraphic schemes (e.g. see Bolli *et al.* 1983).

Remarks: (a) "Biozone" is a general term applied for any kind of biostratigraphic unit regardless of its thickness and extent.

(b) The first and last occurrences of single taxonomic group or several different taxonomic groups may be utilized while defining a biozone. A biozone may also be defined on the basis of relative abundance and any variation related to the content and distribution of fossil taxa.

(c) Reworked fossil should not be considered in biostratigraphic classification. However due to low sedimentation rate fossils of different ages may be associated in a very thin stratigraphic interval, even in a bed.

(d) Although all kinds of fossil taxa can be used for biostratigraphic classification of rocks containing them, however, planktic forms are most useful for this purpose; while benthic forms are good paleoenviornmental indicators.

(e) The same stratigraphic interval can be divided into biozone utilizing different fossil groups. The boundaries of biozones defined utilizing different fossil groups separately not necessarily coincide and the resolution may also differ.

(f) The lateral boundaries of biostratigraphic units are always diachronous in nature; however, they are effective for interpreting chronostratigraphic relation.

(g) The boundaries of biostratigraphic units are independent of lithological change and may or may not coincide with the lithostratigraphic boundary.

(h) A biozone may be divided into "subbiozone" or biozones of related attributes may be group to form a superbiozone.

(i) A barren zone is a stratigraphic interval with no fossils in it in a stratigraphic section.

(j) The name of a biozone should be composed of one or no more than two species names followed by the appropriate type of biozone like *Exus albus* Taxon Range Zone. However, when it become familiar it may be named as *Exus albus* Zone. For Example, *Morozovella velscoensis* Taxon Range Zone, *Morozovella velascoensis* Zone.

2.3. Ecostratigraphic Units

In view of, the scope of classification of rock record on the basis of their environment of origin in interpretation and reconstruction of geological history; and the usage of terms series, stage, system, and facies as stratigraphic units by different earlier authors in the sense above alluded to, the SNCP felt that the general term facies suitably qualified and would be sufficient for all environmental classification. In this category, no other term for higher or lower rank was used and it was decided that the scope of division should be clarified by the qualifying term, e.g. continental facies, paludal facies; marine facies, inner neritic facies, outer neritic facies.

2.4. Chronostratigraphic Units

The chronostratigraphic units are bodies of strata formed during a particular interval of time. A Chronostratigraphic unit is a lithostratigraphic unit; the boundaries of which appear isochronous substantiated by a comprehensive description of evidence in its type area. The overlapping lithostratigraphic and biostratigraphic boundaries are considered best evidence for this purpose. The units recognized in this category are substage, stage, series, system, supersystem in the order of their rank. The proper name of a chronostratigraphic unit is derived from some geographic feature in its type area and it should be adjectival term.

Discussion: The earlier ideas of dividing the rock record into formal chronostratigraphic units have been evolved in the second half of the last century with the wide acceptance of the boundary stratotype concept of Hedberg proposed to the International Geological Congress in 1952 and subsequent arguments. The history of development of chronostratigraphic classification and concept of Global Stratotype Section and Point (GSSP) has been summarized by Stephen *et al.*, (2004).

Although most of the chronostratigraphic units which form the basis of geological time scale have been defined utilizing fossils; the paleomagnetic and chemical signatures of rocks have proven to be a good criterion for chrono-correlation of rocks. (Cande and Kent, 1992,1995; Arenillas, 1999; Aubry *et al.,* 2007 ; Dupuis *et al.,* 2003; Gradstein *et al.,* 2004; Ogg and Gradstein, 2008; McInerney and Wing, 2011; and many other). As organisms adapt particular environments, some time it become impossible to correlate rocks of regions of the world representing distinctive facies because of the presence of endemic faunas; consequently the localized stratigraphic nomenclature develops (Jones and Simmons, 1996 cited Simmons *et al.,* 1997). The correlation of these localized nomenclatures with the standard geological time scale is still far from certain, and calibration using a combination of magnetostratigraphy, relative sea level change, radiometric dating, stable isotope studies, and plankton stratigraphy, is required (Simmons *et. al.,* 1997). [stable isotope studies added]

2.5 Geochronologic units

The Geochronologic units are the abstract divisions of geologic time conceived from the chronostratigraphic units. The units recognized in this category are age, epoch, period and era in order of their rank. The geochronologic units are not stratigraphic in nature but are related to the stratigraphic units. For example, a system is a rock unit while the geologic time interval in which this rock unit was formed is a geochronologic unit.

3. RESULTS AND DISCUSSION

Categories of Stratigraphic Units not discussed in Stratigraphic Code of Pakistan

The publication of the International Stratigraphic Guide (Hedberg 1976; Salvador 1994), North American Stratigraphic Code (NASC) (NACSN 1983, 2005) and many other papers dealing with the subject made evident the inadequateness of Stratigraphic Code of Pakistan. Some formally recognized categories of stratigraphic units in these publications which are not treated in Stratigraphic Code of Pakistan are defensible regarding their scope and applicability in Pakistan, however, demonstration of defense of these categories is beyond the scope of this article and will be dealt in a separate paper. In this section those categories of stratigraphic units will be defined which are not discussed in the Code in the light of a collection of papers published recently and in second half of the last century on the subject, particularly International Stratigraphic Guide (Hedberg, 1976; Salvador, 1994) and NASC (NACSN, 2005).

3.1. Magnetostratigraphic units

A magnetostratigraphic unit is a body of rock characterized by its remanent-magnetic properties distinct from its overlying and underlying rocks having different magnetic properties. The primary formal unit in this category is the magnetostratigraphic *polarity zone* which may be subdivided into *polarity subzones* and two are more polarity zones may be grouped into *polarity superzones* (Salvador, 1994; NACSN, 1983, 2005; Owen, 2009).

Unlike lithostratigraphic units the boundaries of magnetostratigraphic units are isochronous and are very important in chrono-correlation, however, the identification of a particular magnetostratigraphic unit away from its type area requires calibration with biostratigraphic data, or radiometric dating or other events.

The terms *superchronozone, chronozone, subchronozone* and *superchron, chron, subchron* are chronostratigraphic and geochronologic equivalents of *polarity superzone, polarity zone, polarity subzone* repectively.

3.2. Diachronic Unis

A diachronic unit was first time formalized by NACSN (1983) as a temporal unit that is a time unit based on the material referent bounded by the diachronous surfaces representing the unequal span of time from place to place. Although the obvious time transgressive nature of lithostratigraphic and biostratigraphic units from place to place that is a response of the environmental shift has been recognized for a long time ago, no formal terminology has been available to indicate this diachroneity. Some geologists working with Quaternary deposits have found diachronic units useful, but few examples have been published (Owen, 2009).

The time transgressive nature of lithostratigraphic and biostratigraphic units has been pointed out by many workers in Pakistan; but no formal nomenclature has been utilized to show this diachroneity (Davies and Pinfold, 1937; Khan, 1996b; Afzal, 1997; Shah, 2009; Gibson, 2007; Wardlaw *et al.,* 2007; and many other). The formalization and scope of establishment of such a nomenclature has to be discussed.

3.3. Pedostratigraphic units

A pedostratigraphic unit is a buried, traceable, three dimensional body of rock that consists of one or more pedologic horizons (formally called a geosol) developed in the one or more lithostratigraphic, allostratigraphic or lithodemic units. A geosol overlies and underlies the other lithic units. (NACSN, 2005)

In sequence stratigraphic analysis, the ancient soils (paleosoles) provide the basis to delimit the unconformable portion of a sequence boundary, besides; the vertical and lateral variations in paleosoles provide an excellent data to infer the paleotopography, paleoclimatology, and the variation in the depositional environment across the basin (Retallack 1983, 1988; Khan 1996b; Khan *et al.,* 1997; and references therein).

3.4. Allostratigraphic units

NACSN (1983, 2005) recognized an allostratigraphic unit as a formal category of stratigraphic units that is a mappable body of rock, defined and identified on the basis of its bounding discontinuities. The allostratigraphic unit of the NACSN (1983, 2005) is similar to the *sequence* of Sloss *et al.,* (1949), *synthem* of Chang (1975), and *unconformity-bounded unit* of Salvador (1994).

In fact, many of time-rock subdivisions recognized in the early years of geology including many of the systems at their original locations, we still using today, are bounded by unconformities. However, they had not been formally classified on that basis. Thousands of research papers have been written in the last few decades to contribute in the

development of sequence stratigraphy that is based on unconformity related units called sequences (Owen, 2009). The term sequence was originally used by Sloss *et al.,* (1949) for a body of rock bounded above and below by unconformities. Following the definition of Sloss, sequences can only be identified on the basin margins because in most of the cases, unconformities develop towards the basin margin. To recognize a sequence throughout the basin Mitchum *et al.,* (1977), as part of watersheds collection of papers on sequence stratigraphy, revised the definition of a sequence to "a stratigraphic unit composed of genetically related strata bounded at the top and bottom by unconformities or their correlative conformities. A Redefinition of the sequence, lead to the formalization of its four types (Embry, 2002).

3.5. Lithodemic Units

Lithodemic units are similar to lithostratigraphic units but the only difference is that the later obeys the law of superposition while the former do not. They are similar in the sense that the description and the boundaries of both are delineated on the basis of rocks properties such as composition, texture, color, structure, and fabric etc. which are all together designated as lithic characteristics. A lithodemic unit is a defined body of predominantly intrusive, highly metamorphosed, or intensely deformed rock that, because it is intrusive or has lost primary structure through metamorphism or tectonism, generally does not conform to the Law of Superposition. The units recognized in this category are Lithodeme, Suite Supersuite, in order of their rank. A Complex is an unranked lithodemic unit consisting two or more genetic classes of rock. The terms Structural Complex and Volcanic Complex may be applied to a units which consisting of intermixed two or more genetic classes of rock due to deformation or tectonic interleaving and to a unit consisting of volcanic rocks, related intrusions and their weathering products, respectively (NACSN, 1983, 2005).

3.6. Other Units

All the inherent properties of rock can be utilized to organize the rock record (Murphy and Salvador, 1999). The formalization of new categories of stratigraphic units and the retention/rejection practice after examining their practical purpose will lead to the establishment of a precise and up-to-date stratigraphic code. For example, the study of climatic changes through time provides the base to divide rocks into geologic-climate units (NACSN, 2005 cited ACSN, 1970).

Table.3. Hierarchy of stratigraphic units listed in decreasing order of rank. Fundamental units, which are in bold type, are the original, necessary rank within each category. Other ranks are optional. (Modified after Murphy and Salvador, 1999; NACSN, 2005).

Litho-stratigraphic units	Supergroup Group **Formation** Member; Lens; Tongue; Bed; Flow	
Biostratigraphic units	superbiozone **Biozone** Subbiozone	
Chrono-stratigraphic units	Eonothem Erathern **System** Series Stage Chronozone	
Geochronologic units	Eon Era **Period** Epoch Age Chron	
Magneto-stratigraphic units	Polarity super zone Polarity zone Polarity subzone	
Lithodemic units	Supersuite Suite **Lithodeme**	Complex
Pedo-stratigraphic units	**Geosol**	
Diachronic units	**Episode** Phase Span Cline	Diachron
Unconformity related units	**A. Allostratigraphic units**	Allogroup Alloformation Allomember
	B. Unconformity Bounded units	Supersynthem Synthem Subsynthem
	C. Sequence Stratigraphic	Type1 sequence Type2 sequence Genetic stratigraphic sequence T-R Sequence

4. Important Stratigraphic Terminology

In this section definitions of some important stratigraphic terms are given, adopted from Murphy and Salvador (1999).

Stratigraphy. Stratigraphy, from Latin *stratum* + Greek *graphia*, is the description of all rock bodies forming the Earth's crust and their organization into distinctive, useful, mappable units based on their inherent properties or attributes in order to establish their distribution and relationship in space and their succession in time, and to interpret geologic history.

Stratum (plural=strata). A layer of rock characterized by particular lithologic properties and attributes that distinguish it from adjacent layers.

Stratigraphic classification. The systematic organization of the Earth's rock bodies, as they are found in their original relationships, into units based

on any of the properties or attributes that may be useful in stratigraphic work.

Stratigraphic unit. A body of rock established as a distinct entity in the classification of the Earth's rocks, based on any of the properties or attributes or combinations thereof that rocks possess. Stratigraphic units based on one property will not necessarily coincide with those based on another.

Stratigraphic terminology. The total of unit-terms used in stratigraphic classification. It may be either formal or informal.

a. **Formal** stratigraphic terminology uses unit-terms that are defined and named according to guidelines conventionally established.

b. **Informal** stratigraphic terminology uses unit-terms as ordinary nouns in a descriptive sense, not as a part of a specific scheme of stratigraphic classification. The use of informal terms in published documents is *strongly discouraged*.

Stratigraphic nomenclature. The system of proper names given to specific stratigraphic units.

Zone. A minor body of rock in many different categories of stratigraphic classification. The type of zone indicated is made clear by a prefix, e.g., lithozone, biozone, chronozone.

Horizon. An interface indicative of a particular position in a stratigraphic sequence. The type of horizon is indicated by a prefix, e.g., lithohorizon, biohorizon, chronohorizon.

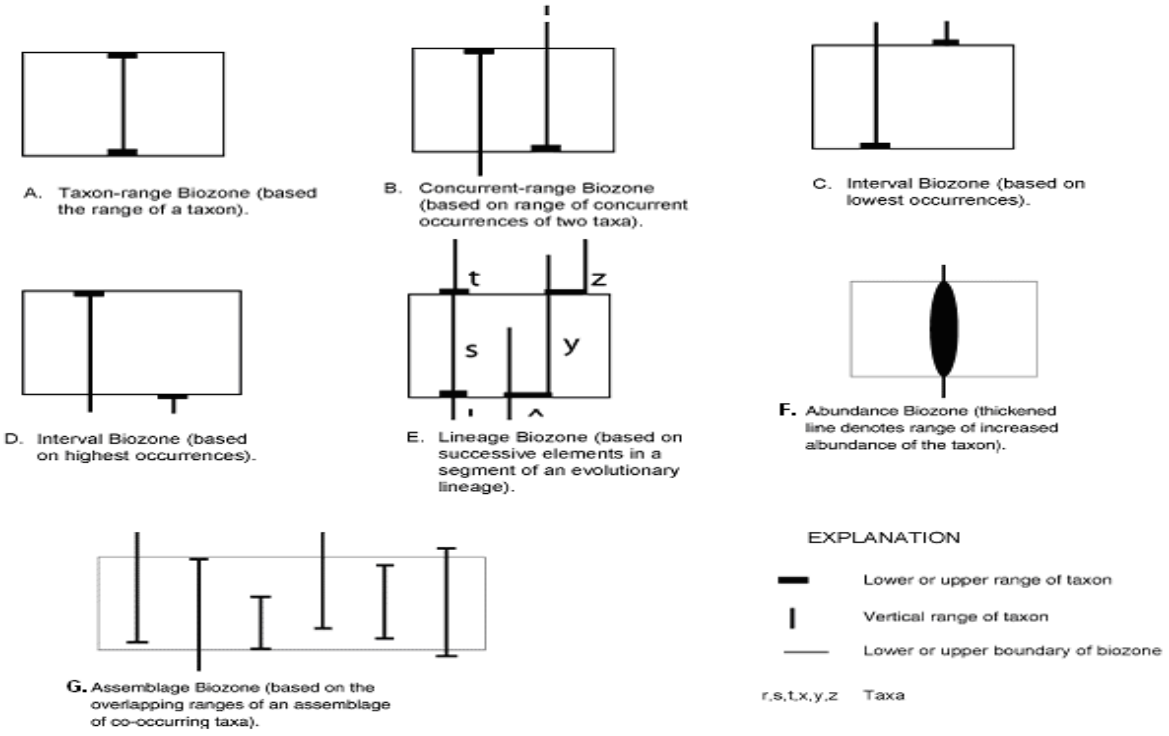
Correlation. A demonstration of correspondence in character and/or stratigraphic position. The type of correlation is indicated by a prefix, e.g., lithocorrelation, biocorrelation, chronocorrelation.

Geochronology. The science of dating and determining the time sequence of the events in the history of the Earth.

Geochronologic unit. A subdivision of geologic time.

Geochronometry. A branch of geochronology that deals with the quantitative (numerical) measurement of geologic time. The abbreviations **ka** for thousand (103), **Ma** for million (106), and **Ga** for billion (milliard of thousand million, 109) years are used.

Facies. The term "facies" originally meant the lateral change in lithologic aspect of a stratigraphic unit. Its meaning has been broadened to express a wide range of geologic concepts: environment of deposition, lithologic **(Fig.1)**. Various kinds of biozones. **(Fig.2,3**) from NACSN, 2005)



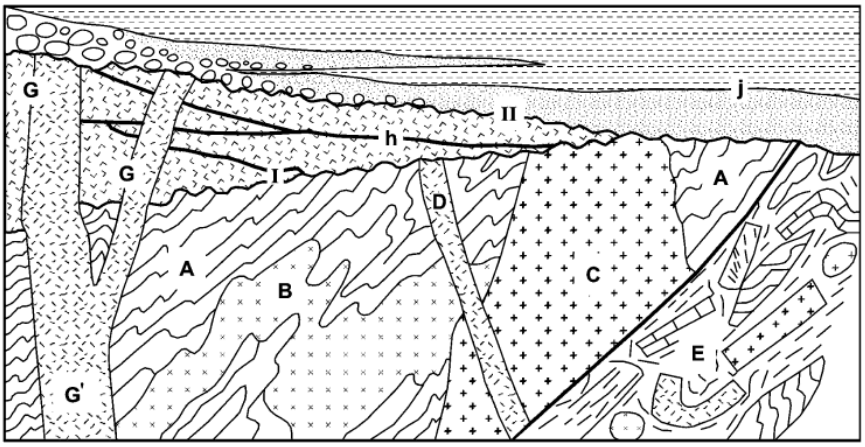


Fig. 2. Lithodemic (lower case) and lithostratigraphic (upper case) units. A lithodeme of gneiss (A) contain an intrusion of diorite (B) that was deformed with the gneiss. A and B may be treated jointly as a complex. A younger granite (C) is cut by a dike of syenite (D) that is cut in turn by unconformity I. All the foregoing are in fault contact with a structural complex (E). A volcaniccomplex (G) is built upon unconformity I, and its feeder dikes cut the unconformity. Laterally equivalent volcanic strata is orderly, mapplable succession (h) are treated as lithostratigraphic units. A gabbro feeder (G), to the volcanic complex, where surrounded by gneiss is readily distinguished as separate lithodeme and named as a gabbro or an intrusion. All the forgoing are overlain, at unconformity II, by sedimentary rocks (j) divided into formations and members. (Fig. from NASC, 2005).

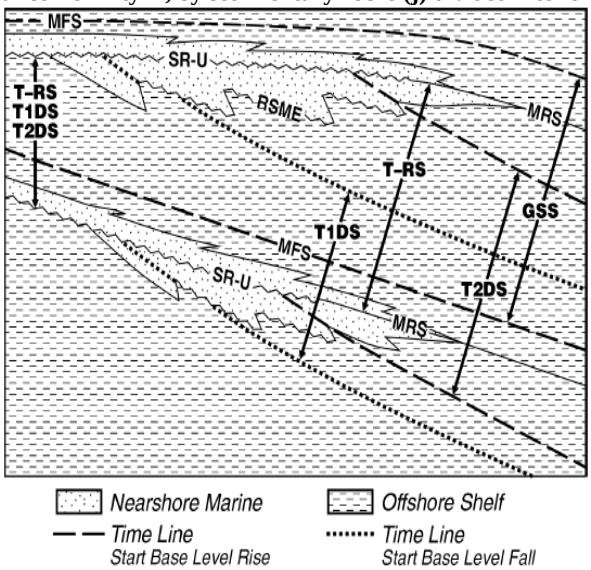


Fig. 3. A schematic cross section illustrating four types of sequence. T1DS = type1 depositional Sequence; T2DS = type2 depositional Sequence; GSS = Genetic stratigraphic sequence; T-RS = Transgressive-Regressive sequence; SR-U = shoreface ravinement- unconformable; MRS = maximum regressive surface; MFS = maximum flooding surface; RSME=regressive surface of marine erosion from Ebray, 2002)

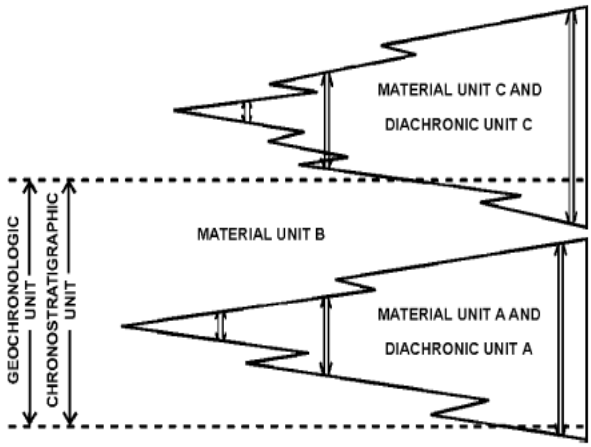


Fig 4. Comparison of geochronologic, chronostratigraphic, and diachronic units. (Fig. from NASC, 2005). Composition, geographic, climatic or tectonic association, etc.

Stratotype (type section). The designated exposure of a named layered stratigraphic unit or of a stratigraphic boundary that serves as the standard of reference. A stratotype is the specific strata sequence used for the definition and/or characterization of the stratigraphic unit or boundary being defined.

Unit-stratotype. The type section of a layered stratigraphic unit that serves as the standard of reference for the definition and characterization of the unit.

Boundary-Stratotype. The specified sequence of strata that contains the specific point that defines a boundary between two stratigraphic units.

Composite-Stratotype. A unit-stratotype formed by the combination of several specified intervals of strata combined to make a composite standard of reference.

Type Locality. The specific geographic locality was the stratotype of a layered stratigraphic unit is situated. The name also refers to the locality where the unit was originally described and/or named. In the case of units composed of nonlayered igneous or metamorphic rocks, the type locality is the specific geographic locality where the unit was originally defined.

Type Area or Type Region. The geographic area or region that encompasses the stratotype or type locality of a stratigraphic unit or boundary.

4 . CONCLUSION AND ECOMMENDATIONS

The obvious advantage of the categories of stratigraphic units which are not treated in the Stratigraphic Code of Pakistan, in calibration of geological time scale, global chrono-correlation of rocks and understanding the other geological aspects, originates the opinion that the code is incomplete and it ought to be updated.

A world wide acceptable stratigraphic code is a demand of effective communication. The International Sub-Commission on Stratigraphic Classification is working to promote the international agreement on stratigraphic procedure terminology but a worldwide acceptable code has not been established yet. However, the International Stratigraphic Guide of ISSC (Hedberg, H, 1976; Salvador, 1994,) provides a reference material for examination and practical purposes and is waiting for suggestions for improvement.

The retention/rejection practice after the formalization of new categories of stratigraphic units from time to time and examining their practical purpose will lead to the establishment of a precise, up-to-date stratigraphic code.

It is recommended that the stratigraphic code of Pakistan should be updated by examining the International Stratigraphic Guide (Hedberg, H, 1976; Salvador, 1994) and other stratigraphic codes; and would be replaced by an International Code as and when approved by the International Geological Congress.

The text of the article is composed of a review of the Stratigraphic Code of Pakistan and a summary or collection of thoughts of the others about principles of stratigraphic classification, procedure and terminology. The whole idea behind this work is to show the deficiencies and need of revision of the Code, and to stimulate the research on the subject in Pakistan.

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