Seismic data processing standards (SEG workshop abstract)

Rick Ottolini

ABSTRACT

Standards are either 'defacto', what is most widely implemented propelled by market forces, or 'specifications' proposed by an authoritative organization. SEG should specify the clearly geophysical aspects of data processing (e.g. data exchange) but identify and encourage the best defacto standards for more computer-oriented matters (e.g. programming language).

SEG should suggest standards for most aspects of seismic data processing to facilitate the connection of data, software and hardware from different sources. The market will adopt or reject them.

Introduction

The SEG is conducting a workshop on seismic data processing standards at the New Orleans annual meeting this year. The question is should SEG set standards to make it easier to connect data, software and hardware from different sources. Issues include standardization mechanisms (personnel, published protocols, certification) and scope of standardization (data, processing parameters, software interfaces, etc.).

The workshop, run by Elmer Eisner and Eike Rietsch, asked SEP for a non-industrial contribution. A relevant issue is whether better standards would help industry better absorb university results and the converse. Industry also looks to universities for new ideas in data processing systems. (Frankly, we consider it the other way around.) A growing force in non-industrial seismological standardization are the government-funded university consortiums such as the Incorporated Research Institutions for Seismology (IRIS).

What is a standard?

I would like to distinguish two types of standards. A *defacto* standard is what is most widely implemented propelled by intrinsic quality and market forces. Standards may also be specified by an authoritative organization. My opinion is that no matter how good the specification, it won't be too useful unless widely adopted. The SEG

should identify and encourage defacto standards before specifying new ones, particularly in areas outside of geophysics.

Scope of standards

I suggest that a SEG standards committee suggest standards in most areas of data processing to best facilitate the connection of data, software, and hardware. The committee should operate in a post-facto mode like many of the IEEE and ACM committees to identify the best defacto standards first.

My specific suggestions are summarized in the table below.

Table 1: Proposed Seismic Data Processing Standards

AREA	TYPE	SUGGESTION
Data exchange	SEG specification	extend to media independent
Model parameters	defacto(?)	Sierra Geophysical consortium
Programming languages	defacto	FORTRAN 8X and C
Programming style	SEG specification(?)	Merlin standards
Operating System	defacto	IBM MVS, VMS, UNIX and OS/2
Processing control	no suggestion	
Vector processing	defacto	FORTRAN 8X or FPSLIB
Parallel processing	no standard (too early)	
Networks	defacto	NFS and X-Windows
Graphics	defacto	GKS and X-Windows
User Interface	defacto	wait a few years

Industrial contribution

I believe the first oil or service company that openly publishes its internal data processing specifications will have computer vendors and universities adopting these standards and producing immediately useful products for that company.

Example: Network distributed processing and graphics

The adoption of network protocols by many computer vendors for file transfer, remote computing, and interactive graphics helps data processing in two ways. First, processing and display software becomes essentially machine independent. Second, various computing tasks can be split among computing elements best suited for a given task. At the Stanford Exploration Project we have been using MIT's X-Window network graphics and Sun Microsystem's Network File System to design multiple-computer interactive data processing software. The application has its computation-intensive parts running on a central super-computer or workstation, interactively displays it on any of several vendors graphics workstations, and stores the data on yet a third computing node.

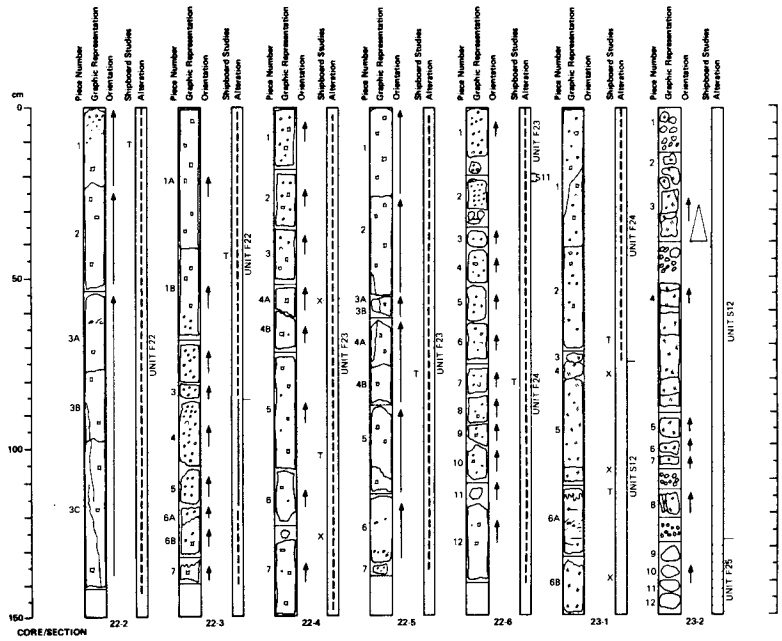
University Concerns

In reflection/refraction seismology universities have formed a number of industry and government funded consortiums (e.g. Houston SAL, CORCORP). Data acquisition often differs from standard industry practice (e.q. very wide offsets, non-sedimentary geology). These can strain data exchange standards (e.g. mega-sample traces) and data processing systems.

Most academic earth scientists would like hands on access to seismic (and non-seismic) data display, processing, and interpretation. The Incorporated Research Institutions for Seismology (IRIS), consisting of about fifty members, is coordinating the design of field acquisition and data processing workstations for members. These would be for earthquake, refraction, and reflection data. Tentative design includes supporting micro-Vaxes and Suns, VMS and UNIX, with X-Windows as the graphics standard. A processing kernel and optical disk storage standard may be specified too.

Exchanges between Universities and Industry

It has been suggested that industry can't easily absorb the computer-oriented results of universities (and vice-versa!). Standards suggested by the SEG on an adventurous company would go a long way to solving this problem. Also, many academic research groups neither have the mandate or personnel to supply such services to industry. Furthermore, universities have the flexibility to develop more 'experimental' computing environments that may not integrate easily with the current environments of industrial sponsors, but could suggest valuable directions for the future.



UNIT F22

468.9–473.2 MBSF **642E–21R–5 (61 cm) TO 22R–3 (86 cm)**

MEDIUM-GRAINED, SPARSELY TO MODERATELY OLIVINE-PLAGIOCLASE PHYRIC, GRAY BASALT FLOW. Euhedral olivines and plagioclase laths < 3.0 mm diameter. Moderately vesicular, filled with dark green smectite. Steeply inclined fracturing filled with smectite. Subhorizontal elliptical vesicles at 22R–2, 60 to 62 cm.

THIN SECTION DESCRIPTIONS

642E–22R–1 (Piece 4, 26–28 cm): 2% plag phenocrysts, 40% plag, 35% cpx, 10% opaques, 13% altered mesostasis.

642E–22R–2 (Piece 1, 9–10 cm): 10% plag phenocrysts. Groundmass: 40% plag, 25% cpx, 5% opaques, 20% altered mesostasis.

642E–22R–3 (Piece 1B, 44–45 cm): 10% plag phenocrysts. Groundmass: 40% plag, 30% cpx, 10% altered ol, 5% opaques, 5% altered mesostasis. Intergranular, subophitic.

UNIT F23

473.2–477.1 MBSF **642E–22R–3 (86 cm) TO 22R–6 (20 cm)**

MEDIUM-GRAINED, SPARSELY OLIVINE PLAGIOCLASE PHYRIC, GRAY BASALT FLOW. Highly vesicular flow top, smectite rimmed or unfilled at top, decreasing to moderate or nonvesicular in lower flow. Euhedral iddingsitized olivines and tabular plagioclase 0.3–0.5 mm diameter. Vesicular base.

THIN SECTION DESCRIPTIONS

642E–22R–4 (Piece 6, 104–107 cm): 10% plag phenocrysts. Groundmass: 35% plag, 35% cpx, 10% opaques, 10% altered mesostasis. Equigranular.

642E–22R–5 (Piece 5, 79–81 cm): 10% plag phenocrysts. Groundmass: 35% plag, 35% cpx, >5% opaques, <15% altered mesostasis.

UNIT S11

477.1 MBSF **642E–22R–6 (20 cm) TO 22R–6 (21 cm)**

DARK RED BROWN TUFF, basaltic vitric.

UNIT F24

477.1–480.5 MBSF **642E–22R–6 (21 cm) TO 23R–1 (73 cm)**

MEDIUM-GRAINED OLIVINE PHYRIC, GRAY BASALT FLOW. Reddened brown gray highly vesicular flow top, iddingsitized olivines common. Vesicles filled with green smectite and some calcite. Some patch smectite alteration, steeply inclined 2.0 mm wide fracturing and brecciation at 23R–1, 17–34 cm.

THIN SECTION DESCRIPTIONS

642E–22R–6 (Piece 7, 77–88 cm): Phenocrysts: <5% altered ol, <10% plag. Groundmass: 40% plag, 30% cpx, <5% altered ol, >5% opaques, 5% altered mesostasis. Subophitic.

642E–23R–1 (Piece 2, 86–89 cm): 3% glomerophyric plag, 30% plag, 30% cpx, 7% opaques, 30% altered mesostasis.

UNIT S12

480.5–482.7 MBSF **642E–23R–1 (73 cm) TO 23R–2 (125 cm)**

GREEN TO RED BROWN OR OLIVE BROWN TUFF. Median grain diameter of 0.15 mm, with some fragments of finer grained differentiated tuffs and some medium sorted basaltic tuffs. Irregular bedding features.

UNIT F25

482.7–485.6 MBSF **642E–23R–2 (125 cm) TO 23R–3 (126 cm)**

FINE-GRAINED, APHYRIC TO MODERATELY OLIVINE-PLAGIOCLASE PHYRIC BASALT FLOW. Moderate vesicularity, but variable and locally highly vesicular, some breccia zones. Vesicles filled with dark green smectite, locally calcite.

THIN SECTION DESCRIPTION

642E–23R–3 (Piece 10, 47–49 cm): <2% plag phenocrysts. 40% plag, 30% cpx, >5% altered ol, 5% opaques, >10% altered mesostasis. Brecciated.