INTERPRETATION OF SEISMIC REFLECTION

(cod.: “950 SM”)

Course for

Laurea Magistrale in Geoscienze

teacher: Anna Del Ben

A.A. 2021-22

INTERPRETAZIONE di DATI SISMICI a RIFLESSIONE

- Orario del corso: Martedì 9,00-11,00 Aula B, Ed. O
  Mercoledì 9,00-11,00 «
- Organizzazione del corso: 4 CFU lezioni frontali/su piattaforma digitale
  2 CFU esercitazioni
- Contributi da personale esterno: esperti OGS et al.
- Reperibilità per chiarimenti e spiegazioni:
  11,00-13,00 martedì e mercoledì
  anche via e-mail
- Modalità d'esame: esame orale (interpretazione e discussione di un profilo sismico, relazione sul lavoro fatto durante le esercitazioni, contenuti teorici del corso) *data da concordare*
- Contenuti del corso …
- Bibliografia …

CONTENUTI SINTETICI DEL CORSO

- **DATI DISPONIBILI** in rete**:** Progetti ViDEPI e Virtual Seismic Atlas
- **ASSUNZIONI GEOFISICHE DI BASE:** Onde Riflesse e Rifratte, Legge di Snell, Iperbole di Riflessione, Principio di Huygens, Coefficiente di riflessione, Sismogrammi sintetici, Dati sismici *stack* e migrati, Costanti Elastiche, Risoluzione verticale, Risoluzione orizzontale, Fenomeni di *Tuning*
- **DISTURBI** PRESENTI nel DATO SISMICO **:** Multiple, Diffrazioni , Effetti di orizzonti pendenti, Effetti della Migrazione, *Pull-up* e *pull-down velocity* e conversione/migrazione in profondità di dati sismici
- **COLLEZIONE ED ANALISI DI DATI SISMICI :** Linee sismiche regionali**,** Maglia linee sismiche e loro Intersezioni, Attributi Sismici, Sismica 3-D e 4-D, *Time Lapse,* Sismica 4C
- **TARATURA CON POZZI :** Utilizzo di pozzi stratigrafici per l'interpretazione sismica, *Sonic log*, etc
- **SISMOSTRATIGRAFIA :** *Unconformities*, Facies sismiche e modelli deposizionali , *Sequence* e *Seismic stratigraphy, System Tracts, etc*
- RICONOSCIMENTO SISMICO DI STRUTTURE DI **REEF, MARGINI DI PIATTAFORMA, PIATTAFORME ISOLATE**
- RICONOSCIMENTO E INTERPRETAZIONE SISMICA DI **PROCESSI HALOCINETICI**
- RICONOSCIMENTO DI **FAGLIE** E STILI TETTONICO-STRUTTURALI : Faglie normali, inverse e sistemi trascorrenti, Ricostruire il pattern delle faglie
- **SISMICA CROSTALE**: Caratteristiche sismiche di crosta continentale e oceanica , Progetti di Sismica Crostale (CROP, etc)
- INDICATORI SISMICI DELLA **PRESENZA DI FLUIDI** : *Bright , Dim e Flat spots*, Analisi di Porosità e Permeabilità,
- **SEMINARI** da parte di ESPERTI su *Bottom Simulating Reflector* (BSR), Stoccaggio CO_2, etc
- **ESERCITAZIONI** con software Petrel: Picking di riflettori, Conversione in profondità, Mappatura di orizzonti e mappe isopache , Sezioni cronostratigrafiche, *Case history*

BIBLIOGRAPHY

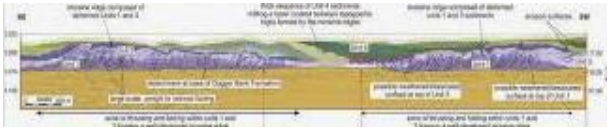
- **Lines and Newrick - FUNDAMENTALS OF GEOPHYSICAL INTERPRETATION**
- **Herron – FIRST STEP IN SEISMIC INTERPRETATION**
- **Yilmaz - SEISMIC DATA ANALYSIS**
- **Lindseth - DIGITAL PROCESSING OF GEOPHYSICAL DATA - A REVIEW**
- **Sheriff and Geldart - EXPLORATION SEISMOLOGY**
- **Anstey - SEISMIC INTERPRETATION - The Physical Aspects**
- **Avseth et al. - QUANTITATIVE SEISMIC INTERPRETATION**
- **Shaw, Connors and Suppe – SEISMIC INTERPRETATION OF CONTRACTIONAL FAULT- RELATED FOLDS, AAPG Seismic Atlas, Studies in Geology, 53**
- **AAPG Mem.26 - SEISMIC STRATIGRAPHY - Application to Hydrocarbon Exploration**
- **Emery and Myers - SEQUENCE STRATIGRAPHY**
- **Davies, Posamantier, Wood and Cartwright – SEISMIC GEOMORPHOLOGY Application to Hydrocarbon Exploration and Production Geol. Soc. Sp. Publ., N.277**

Interpretation of Seismic Reflection

- It is fundamental in the research applied to the geoscience;
- It furnishes information about: - geometries of stratigraphic sequences, structural and tectonic features,
  - seismic velocities,
  - lithological characteristics;
- It gives a geological meaning to geophysical data, practically it represents a geophysical inversion.

> *Interpretation is telling the geologic story contained in seismic data. It is correlating the features we see in seismic data with elements of geology as we know them. The story is read from a book having many chapters, some of which are either illegible or unintelligible, and others are lost or yet to be written. And although the story doesn't always have a happy ending, only in its telling do we expand our knowledge.*
>
> —Interpreter Sam

SEISMIC DATA ANALYSIS

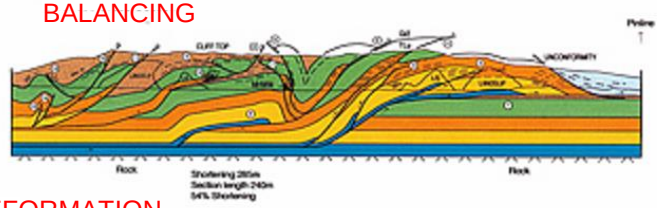


- Interpretation should be **CONSISTENT** with the available (geological and geophysical) data → (*constraints matter*)

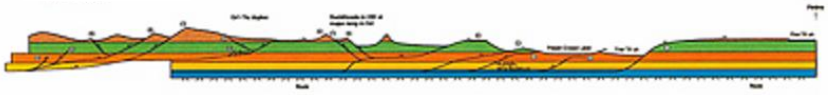
  "*Seismology is a subset of geophysics*"…..

INTERPRETATION

BALANCING



RETRO-DEFORMATION



- It is useful to reconstruction of:
  2D sections, structural maps, fault systems, *slumping* and *seismic hazard,* retrodeformation, subsurface exploration for mineral and hydrocarbon research, for CO2 and H2 storage, for infrastructures (telephone cables, pipeline, etc) safety.

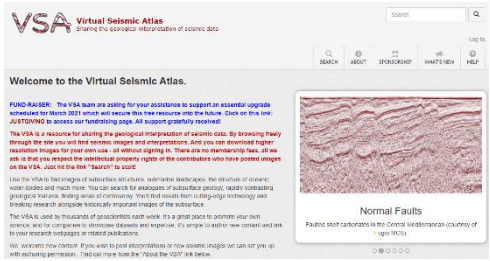
- Ideal interpreter:
  team of geologists/geophysicists/physicists with different skills that works in synergy. *…human intervention and computer HW and SW*" (Lines and Newrick, 2004)
  Furthermore: "*Interpretation is a combination of both **art and science*** " «

Web sites
Seismic Data and Knowledge Deepening

- Seismic profiles and calibration wells

  -Banca Dati ViDEPI: http://www.videpi.com/videpi/videpi.asp

  -Virtual Seismic Atlas: http://www.seismicatlas.org/

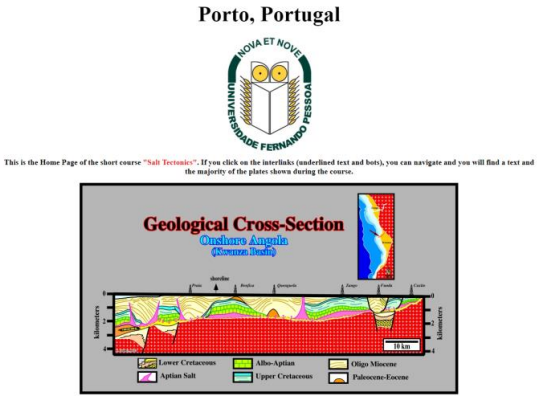


- Seismostratigraphy

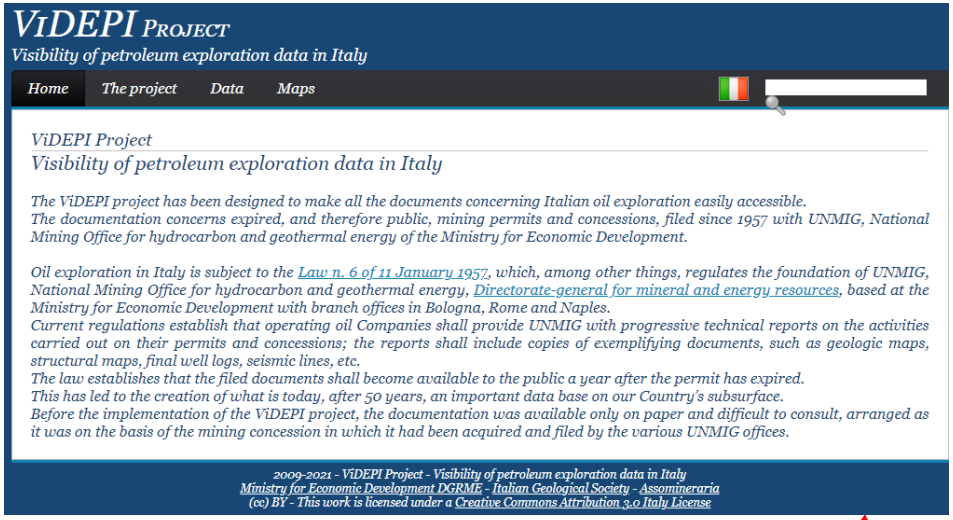
http://sepmstrata.org/page.aspx?pageid=1

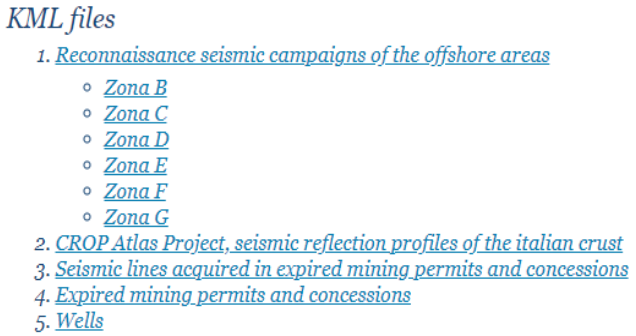
- Halokinetic tectonics

http://homepage.ufp.pt/biblioteca/SaltTectonics/WebSaltTectonics/Index.htm

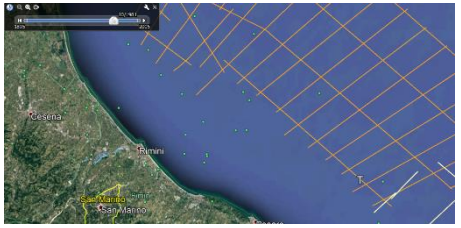


Seismic profiles in Italy onshore and offshore
ViDEPI Project

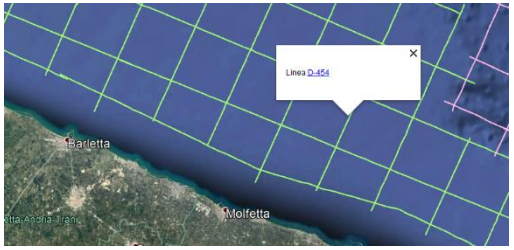


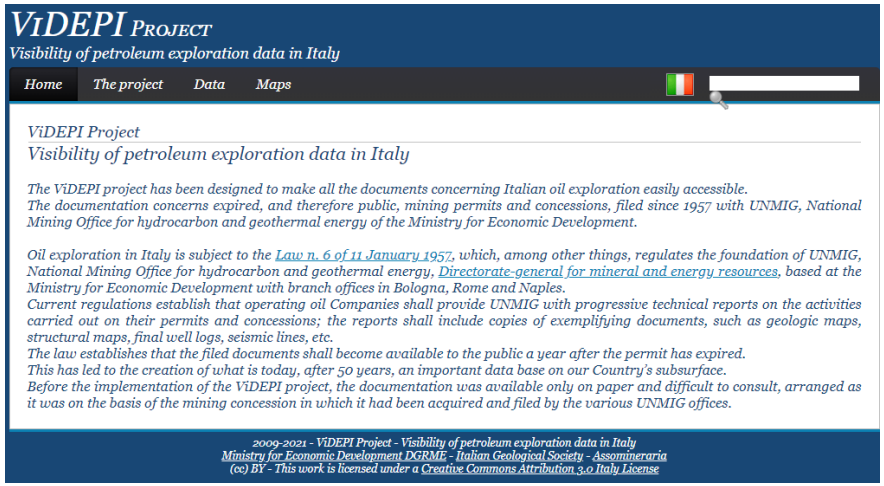


- Open Google Earth on your PC
- From a search engine get to the ViDEPI project site
- Click on “Maps” and than "Download KML files“
- Click on “1. Reconnaissance seismic compaigns of the offshore areas” and then on the bar at the bottom of the downloaded link: Google Earth will open with the positions of all the seismic profiles relating to
- Same procedure for CROP and other profiles (points 2, 3, 4) and wells (point 5 plus bar).
- Clicking on a profile or well, you can select to see the corresponding pdf file

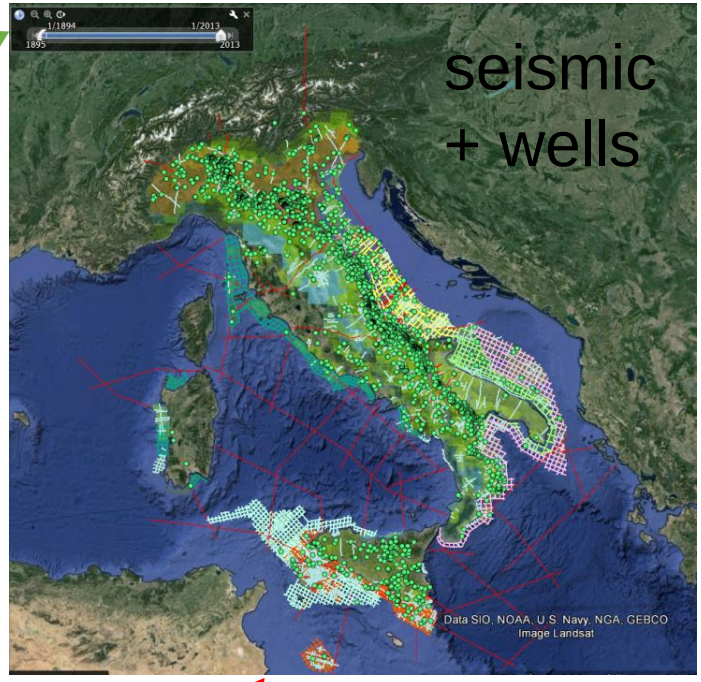


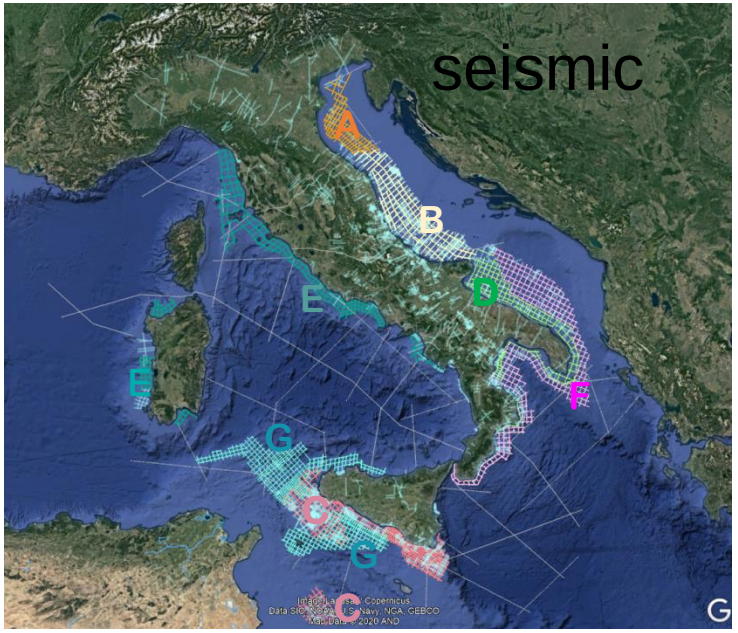
Note that wells can be partially evidenced in time with the top left bar in Google Earth





With this bar position of the wells will be evidenced on the base of their drilling age





Zone A
Zone B
Zone C
Zone D
Zone E
Zone F
Zone G

PROGETTO VIDEPI

Visibilità dei dati afferenti all'attività di esplorazione petrolifera in Italia

Home | Il progetto | I dati | Cartografia

Linee sismiche

Sismica riconoscitiva ZONA F

Linea F76-017

Torna alla pagina precedente

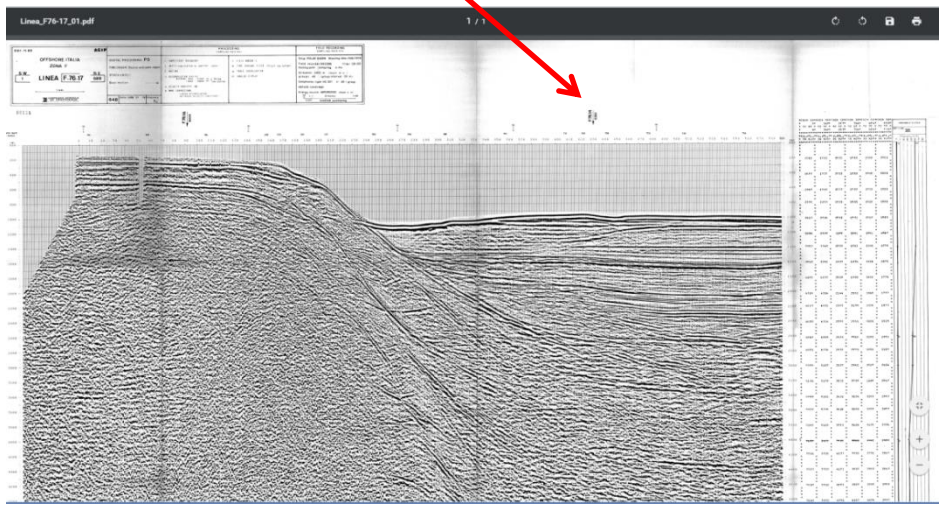
1. Linea_F76-17_01 (2.458 Kb)
2. Linea_F76-17_02 (1.586 Kb)
3. Linea_F76-17_03 (1.433 Kb)
4. Linea_F76-17_04 (1.720 Kb)
5. Linea_F76-17_05 (1.679 Kb)

Visualizza in Google Maps

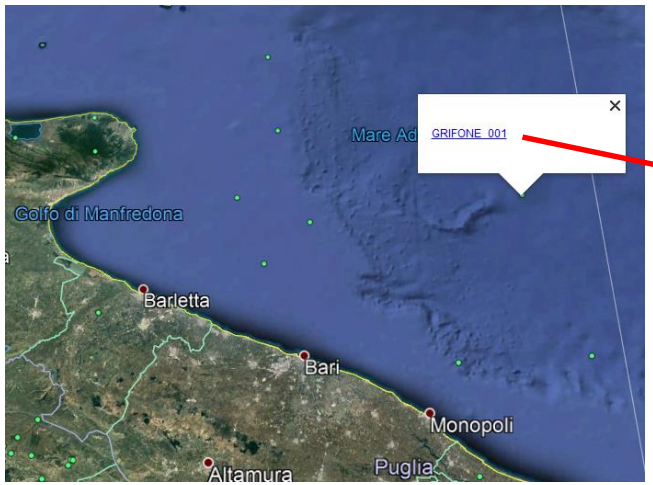
La visualizzazione in Google Maps ha soltanto valore indicativo

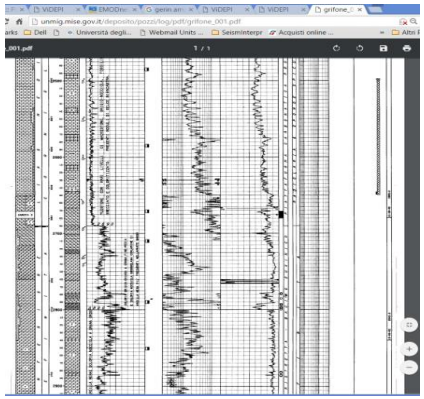
Nota:

I file immagine delle linee sismiche sono in formato raster e pertanto la loro visualizzazione richiede il download completo del file pdf, con tempi di attesa che a volte possono essere lunghi.

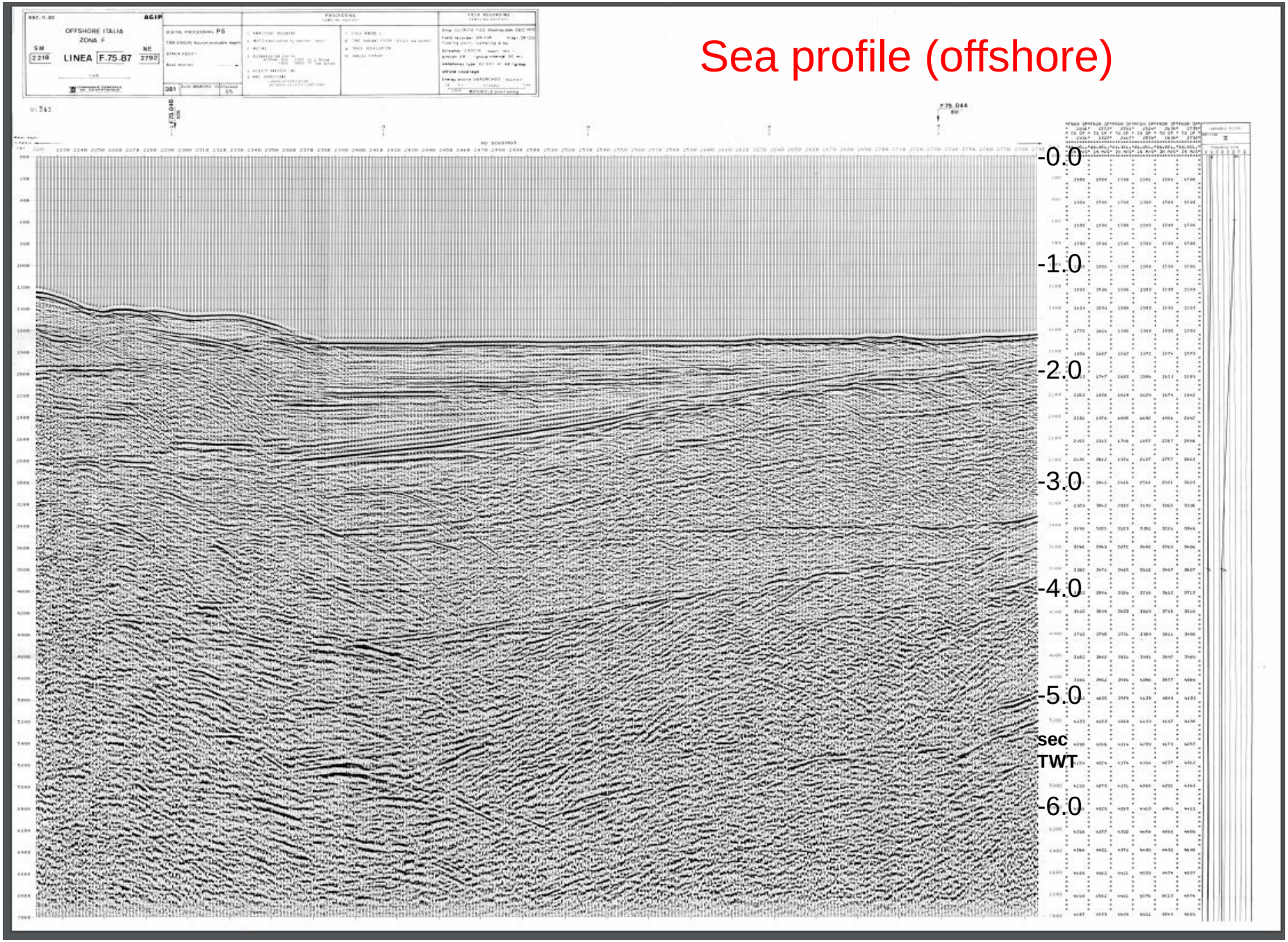


Click on the name of a profile or well :
A link to the file or more files will open to go to the pdf files.





Sea profile (offshore)



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Land profile (onshore)