TMI-004: Ward Abbott's Online Atlas

OBJECTIVES: Dynamic Resources Corporation (DRC) proposes presale of the *Ward Abbott's Online Atlas* in exchange for a credit of $1/N^{th}$ of 50% of project Cash Flow, where N is the number of Prepaying Clients (not to exceed 5). This credit will be returned to the Prepaying Client or go towards annual maintenance fee. This project has been planned since the late 1980's. With Dynamic's focus on using analogs to aid exploration efforts, it is now scheduled to start in July of 2001, with the first analogs being put online in September of 2001 (prototype images are at http://www.walden3d.com/Abbott). It is clear to Dynamic that industry leaders will find this outcrop, seismic, and well log library to be very valuable as an exploration and development tool. Additionally it will insure a common visual language and common analog classification scheme for discussing joint projects, like a new CLP (exploration Concept, Lead, or Prospect).

RETURNS: Participating company explorationists will have access to hundreds of analog examples of outcrop photos, seismic cross-sections, and well logs, through a standard Internet Browser. The examples will each be classified, using a modification of the attached Index. There will be raw data (photographs), along with alternative interpretations of each cross-section, all designed to help guide interpreters and enable understanding and communication of complex geology. Participating companies will have the right to hire members of the Technology Team to expand the project to capture their outcrop, seismic, and well log analogs on either a public or proprietary basis. Several key examples will be converted into 3-D models for review with a VRML viewer. Plus, if this project is as successful as anticipated, Prepaying Clients will never have to pay the annual maintenance fee, and will actually get their investment returned within a couple of years, in addition to having early access to the *Online Atlas* and an opportunity to guide the project.

ESTIMATED COSTS 8/8TH'S:

- Dry Hole Cost (Pre-Purchase Corporate License): $ 50,000.
- Completion (total productization and licensing cost): $1,000,000.
- Leasehold and G&G (annual maintenance fee): $ 10,000./year.

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TEAM: Ward Abbott, retired Shell Oil and then Occidential Petroleum Chief Stratigrapher, who now lives in Southern Utah, is the Team Leader. Ward brings an experience and knowledge base, possibly unequalled anywhere else in the industry. Roice Nelson is on the team and will coordinate the start-up phase and initial image capture and indexing. Bryan Bentz, formerly with BB&N, will build the database-to-web interface. Riley Skeen, who has 25+ years experience in oil and gas exploration, project management, and data collection will be supporting public and proprietary extensions of the *Online Atlas*.

SUMMARY: The stratigraphic and structural processes creating the rock record are repeated worldwide, across geologic time, and at various scales. Access to known analog examples of outcrop, seismic, and well log cross-sections guides geoscientists, enabling understanding of complex geology across disciplines as well as communication to management, partners, and investors.

Dynamic Resource Corporation's first AOI (Area-of-Interest) is the Gulf Coast of the United States. To provide interpretation teams with classic analog examples related to this depositional environment, Ward provided 6 images of parallel delta outcrops, 6 images of distal fan outcrops, and 4 images of turbidite outcrops. These can be reviewed are at http://www.walden3d.com/Abbott, where each image is a hyperlink to a larger version of itself. To demonstrate a little more how the final results will look, a sequence boundary / interval interpretation was overlaid on three of the parallel delta outcrop images (an example: http://www.walden3d.com/Abbott/images/ParallelDelta_PriceUpperCretaceousOverviewSands.gif). When the *Ward Abbott Online Atlas* is released to users there will be detailed interpretations, along with textual and audio descriptions of each analog example. There might be a dozen different versions of each analog, each version classified against the specific geology which that interpretation highlights. It is envisioned that several of the key examples will be turned into 3-D models, to be reviewed using something like a VRML viewer.

There are hundreds of photos from outcrops all across the globe and for all different geologic times in Ward Abbott's personal library. Academia and oil companies have additional hundreds of analogs. Dynamic intends to capture Ward Abbott's library, use it to refine a universal analog index, and then add to this library from industry and academia. In addition to online access, we anticipate ELDOs (ELectronic DOcuments) with CD type distribution will become a common tool for obtaining analogs to supplement geotechnical reports.

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NetWork RANK: #2: IG11:88

SCOPE: We propose a 3-phase project to produce a robust, easy-to-use implementation of the *Ward Abbott Online Atlas*. There has been over a decade of think-time put into this project, and based on this work Ward has been organizing and getting his outcrop library ready to be captured. He currently has between 800 and 1,000 outcrop images, hundreds of seismic lines, and numerous core and log examples, all of which will can be released for sale will be made part of the first release of the *Online Atlas*.

Phase 1, May to June 2001: A few sophisticated exploration companies who have expressed interest in this project will be recontacted and invited to pre-purchase the *Ward Abbott's Online Atlas.* Companies who prepay prior to Friday 15 June 2001, and who commit to provide and index 100 analog photographs from their files, will receive a permanent corporate license to the *Online Atlas*. In addition, a meeting will be held on Wednesday 20 June 2001 for company representatives who wish to be involved in finalizing the initial indexing schema.

Phase 2, July to August 2001: Ward Abbott's photographic library will be captured, indexed, and put on-line to kick this project off. In addition, the team will start to develop interpretations of the outcrop photos, synthetic logs, and synthetic seismic sections. In addition, for a few select areas, 3-D immersive reality models of outcrop analogs will be created to allow a visceral understanding of the related geologic concepts.

Phase 3, September 2001 to September 2001: Industry and academic examples will be added to the *Online Atlas.* As many immersive reality models as can be developed, based on the number of companies who participate, will be added. Course materials for those wishing to electronically review the geologic concepts captured will be developed, and portable ELDOs for self-guided field trips will be evaluated and tested. Finally the first annual conference for those using the *Online Atlas* will be held in the fall of 2002, probably in Washington, Utah, in conjunction with field trips to some of the outcrops which have been documented.

COMPETITION: With the expansion of the WWW there are more and more analogs becoming available. However, there are none these analogs which are indexed and organized in a manner that would enhance communication of complex geological ideas across disciplines, nor are easy to find, nor access, nor be easily incorporated into reports and project reviews.

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NEXT ACTION REQUIRED: This proposal will be circulated to key oil company representatives, and those companies interested in pursuing the project enough to prepay for access to the material, based on the schedule set out above, will be invited to the organization meeting on 20 June 2001 in Houston, Texas.

PRINCIPAL RISK: In order for *Ward Abbott's Online Atlas* to be useful, it needs to have a very user friendly front-end. Interpreters, processors, trainers, geologists, geophysicists, engineers, managers, etc. all need to be able to access images that illustrate a problem they are working on within a few keystrokes. Immersive models must be straight forward to use and intuitive to navigate through. Dynamic believes we have assembled a team with the experience to minimize the impact of this risk.

ESTIMATED INITIAL COSTS:

Item	Cost
Dynamic's Administrative Fee	$26,250
Royalty Fee for Non-Sponsor Images ($150/image + 25% of sales proportional to relative number of images contributed)	$112,500
Image Capture, Interpretation, and Indexing	$61,250
Software/User Interface Development	$50,000
Cost to not turn Atlas into a Product (analog to drry hole cost)	**$250,000**
Cost to Productize On-Line Atlas (analog to comletion cost)	$1,000,000

Note that the *Ward Abbott's Online Atlas* is a peripheral, but supporting activity to Dynamic's main business of developing CLPs and selling them for a fee and an override. Therefore, Dynamic will have open financial projections and records on this project for Prepaying and regular Clients. If there is only 2 Clients, instead of 25, at the end of the first year, the project will be scaled back proportionally, based on what moneys Dynamic is able to put into the project. Likewise, if 100 universities or other schools decide they want to extract and input information from and into this atlas for classes and research, the project will expand accordingly. The above figures represent Dynamic's best guess of the acceptance of *Online Atlas* project in 2001-2002.

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ESTIMATED ECONOMICS:

Quarter:	Jul-Aug2001	Sept- Dec 2002	Jan-Mar 2002	Apr-Jun 2002	Jul-Sept 2002
Clients					
Number of Prepaying Clients (including propprietary projects)	5	1	1	1	
Number of Clients	0	4	4	4	
Cumulative Clients	5	10	15	20	2
Revenues					
Online Atlas Sales	$250,000	$250,000	$250,000	$250,000	$250,00
Proprietary Atlas Projects	$0	$50,000	$100,000	$150,000	$200,00
Maintenance	$0	$0	$0	$0	$50,00
TOTAL REVENUE	**$250,000**	**$300,000**	**$350,000**	**$400,000**	**$500,00**
Expenses					
Number of Images to Capture and Index	750	750	750	750	75
Royalty Fee for Non-Sponsor Images	$112,500	$56,250	$56,250	$56,250	$56,25
Image Capture and Indexing	$37,500	$37,500	$37,500	$37,500	$37,50
Software/User Interface Development	$50,000	$25,000	$25,000	$25,000	$25,00
Packaging and Documentation	$18,750	$18,750	$18,750	$18,750	$18,75
3-D Immersive Reality Models	$0	$75,000	$150,000	$225,000	$300,00
Associated Expenses (travel to Utah, etc.)	$5,000	$3,000	$3,000	$3,000	$3,00
TOTAL EXPENSES	**$218,750**	**$212,500**	**$287,500**	**$362,500**	**$437,50**
Gross Revenues	**$31,250**	**$87,500**	**$62,500**	**$37,500**	**$62,50**
Taxes at 38%	$11,875	$33,250	$23,750	$14,250	$23,75
Cash flow	$19,375	$54,250	$38,750	$23,250	$38,75
Cumulative Cash Flow	**$19,375**	**$73,625**	**$112,375**	**$135,625**	**$174,37**

Dynamic's Anticipated Profit (50% of Cumulative Cash Flow)	$87,187.5
Anticipated return to 5 Prepaying Clients	$87,187.5
Anticipated amount returned to each Prepaying Client	**$17,437.5**

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. . . Indices for each photograph in Ward Abbott's On-Line Atlas

1. **Infinite Grid^{SM} Current Location**
    A. Camera Location: x, y, z
    B. Horizontal and Vertical Scale
    C. Camera Direction: angle horizontal, angle vertical
    D. Sunlight, Temperature, Pressure, and Wind Conditions
2. **Timedex^{SM} Location**
    A. Date photo taken
    B. Age of bottom rocks in photo
    C. Age of intermediate rock intervals
    D. Age of top rocks in photo
3. **Type of Display**
    A. **Log**
    B. **Well Log Cross-Section**
    C. **Seismic Cross-Section**
    D. **Outcrop**
        a. **Synthetic Well Log Section**
        b. **Synthetic Seismic Section**
        c. **3-D Immersive Reality Model of Outcrop**
4. **Episodic Depositional Analysis**
    A. **Basin Type and Structural Style:**
        a. Thermal Basins:
            I. Interior Sag (Cratonic Basins)
            II. Passive Margins:
                i. Rift
                ii. Late Rift Phase
                iii. Drift
            III. Rift Grabens:
                i. Lacustrine Section
                ii. Back Arc
        b. Flexure Loading Basins:
            I. Continent-Continent:
                i. Foreland
            II. Ocean-Continent Trench:
                i. Forarc
                ii. Backarc
        c. Wrenches:
            I. Rhomo Chasms
    B. **Identify Structural Style within Basin:**
        a. Gravity Control:
            I. Shale Diapirism
            II. Salt Diapirism
            III. Growth Faults
        b. Mechanical Subsidence
    C. **Rock Type**
        a. **Siliciclastic Rocks:**

Size	**Sediment**	**Rock**
Over 2mm	Gravel	Conglomerate or Breccia
1/16-2mm	Sand	Sandstone: Quartzose sandstone (mainly quartz) Arkosic Sandsone (over 20% feldspar Graywhacke (poorly sorted with clay)
1/256-1/16 mm	Silt	Siltstone (mudstone)

Less than 1/256 mm	Clay	Shale (splits easily on bedding planes)

b. **Carbonate Rocks:**

Rock	Description
Limestone	calcite, effervescence with dilute hydrochloric acid, biologic origin, fo
Dolostone (dolomite)	effervescence after scratching to produce powder, calcite replcement,
Chert	composed of chalcedony, named agate, flint, black chert, etc.

c. **Carbonate-Evaporite Rocks:**

Rock	Description
Rock Salt	composed of halite, recognized by cubic cleavage and taste, formed when seas ev
Gypsum	hydrous calcium sulfate, most common sulfate mineral, often interbedded with sl
Chalk	soft, white limestone formed by accumulation of shells of microscopic animals
Diatomite	soft, white rock composed of the remains of microscopic plants, lacks effervesce

d. **Carbonate-Siliciclastic Rocks:**

Rock	Description
Coal	derived from wood and plant tissues, intricate mixture of complex carbon
Iron Oxides	includes ferric oxide (hematite), ferrous oxide (magnetite), hydrous iron ox
Phosphate Rocks	consists largely or entirely of phospahte minerals, calcium phosphates of t
Bauxite	claylike material, mixture of hydrated aluminum oxides, principal source o
Potash	various potassium compounds or salts, including potassium carbonate, pot and potassium monoxide

D. **Sedimentary Structures**

a. Primary Sedimentary Structures: contemporaneously with deposition
   I. Physical Boundary:
      i. Discontinuity
      ii. Synchronous
      iii. Diachronous
   II. Lithofacies Boundary:
      i. Synchronous
      ii. Diachronous

b. Secondary Sedimentary Structures: subsequent to deposition
   I. Folds:
      i. anticline (convex upward)
      ii. syncline (concave upward)
      iii. symmetrical fold (vertical axial plane)
      iv. asymmetrical fold (inclined axial plane and limbs dip in opposite directions)
      v. overturned fold (inclined axial plane and both limbs dip in same direction)
      vi. recumbent fold (axial plane essentially horizontal)
      vii. isoclinal fold (two limbs dip at equal angles in the same direction)
      viii. fan fold (both limbs are overturned)
      ix. monocline fold (plateaus, where bedding relatively flat, strata has locally steeper dip)
      x. homocline (strata that dip in one direction at a uniform angle)
      xi. closed fold (deformation causes flowage of mobile beds so they thicken and thin)
      xii. open fold (no flowage has taken place)
      xiii. drag folds (where competent beds slide past incompetent beds)
   II. Faults:
      i. normal fault
         1. parallel faults (multiple faults with same strike and dip)
         2. en e'chelon faults (short faults that overlap each other)
         3. peripheral faults (circular or arcuate faults bounding or part of circular area)

4. radial faults (faults that radiate out from a point)

ii. thrust fault

1. reverse fault

iii. strike-slip fault

III. Salt Weld

E. **Depositional Environments, as defined by paleowater depths**

a. fluvial environment

b. marine environment

I. 000m = shoreline

II. 010m+- fair weather wave base

III. 030m+- average storm wave base

IV. 050m+- major storm wave base

V. 100m = top outer nertic

VI. 200m = top upper bathyal

VII. 500m = top middle bathyal

VIII. 1,000m = top lower bathyal

IX. >2,000m = abyssal

F. **Depositional Systems, as defined by lithofacies boundaries**

a. lacustrine (lakes):

I. synchronous

II. diachronous

b. fluvial (river systems):

I. synchronous

II. diachronous

c. marine:

I. synchronous

II. diachronous

G. **Cyclic Startigraphy Analysis**

a. **Termination Description:**

I. At Upper Boundary:

i. Truncation (Red)

ii. Toplap (Cyan)

iii. Apparent Truncation (Olive)

II. At Lower Boundary:

i. Onlap (Orange)

ii. Downlap (Green)

III. Internal to Geologic Unit:

i. Divergent (Purple)

IV. Uncertain (Yellow)

V. Faults (Black)

VI. Missing

b. **Boundary Description:**

I. Top of Unit:

i. Regional Onlap (Sequence Boundary) (Orange):

1. Type I Unconformity (Orange-Red):

A. Unconformity-Structure (Orange-Red-Black)

B. Unconformity-Stratigraphy (Orange-Red-Brown):

a. Incised Valleys (Orange-Red-Ocean)

b. Headward Erosion (Orange-Red-Green)

c. Deep Sea Currents (Orange-Red-Blue)

d. Ravinement Surface (Orange-Red-Lime)

C. Conformable

2. Type II Unconformity:

A. Conformable (Subareal Erosion) (Olive)

ii. Regional Downlap (Systems Tract Boundary) (Olive):

1. Maximum Flooding Plane (Lime)

2. Top Slope Fan (Brown)

3. Top Basin Floor Fan (Yellow)

iii. Transgressive Surface (Systems Tract Boundary) (Ocean Blue):

1. First flooding plane surface at the base of the Transgressive Systems Tract (White)

iv. Parasequence Boundary (White):

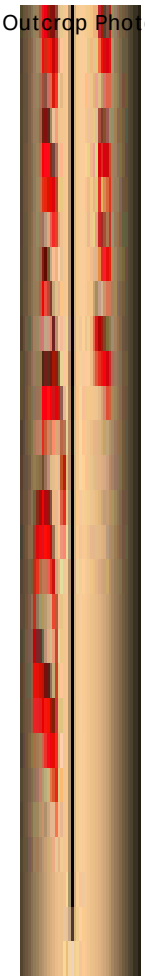
1. Correlation Marker within a Systems Track

2. Flooding Surface between boundaries i, ii, or iii

II. Base of Unit:
- i. Regional Onlap (Sequence Boundary) (Orange):
  1. Type I Unconformity (Orange-Red):
     - A. Unconformity-Structure (Orange-Red-Black)
     - B. Unconformity-Stratigraphy (Orange-Red-Brown):
       - a. Incised Valleys (Orange-Red-Ocean)
       - b. Headward Erosion (Orange-Red-Green)
       - c. Deep Sea Currents (Orange-Red-Blue)
       - d. Ravinement Surface (Orange-Red-Lime)
     - C. Conformable
  2. Type II Unconformity:
     - A. Conformable (Subareal Erosion) (Olive)
- ii. Regional Downlap (Systems Tract Boundary) (Olive):
  1. Maximum Flooding Plane (Lime)
  2. Top Slope Fan (Brown)
  3. Top Basin Floor Fan (Yellow)
- iii. Transgressive Surface (Systems Tract Boundary) (Ocean Blue):
  1. First flooding plane surface at the base of the Transgressive Systems Tract (White)
- iv. Parasequence Boundary (White):
  1. Correlation Marker within a Systems Track
  2. Flooding Surface between boundaries i, ii, or iii

H. **Interval Description:**
- a. Megaunit (Sequence Set)
- b. Sequences
- c. Systems Tracts:
  - I. Highstand Systems Tract
  - II. Transgressive Systems Tract
  - III. Lowstand Systems Tract:
    - i. Lowstand Prograding Wedge
    - ii. Lowstand Slope Fan
    - iii. Lowstand Basin Floor Fan
  - IV. Shelf Margin Systems Tract
- d. Parasequences

I. **Facies Description:**
- a. Identify Top of Sequence (A):
  - I. Toplap
  - II. Concordance
  - III. Erosional Truncation
- b. Identify Base of Sequence (B):
  - I. Onlap
  - II. Concordance
  - III. Downlap
- c. Identify Content of Sequence (C):
  - I. Parallel:
    - i. Parallel
    - ii. Subparallel
    - iii. Divergent
    - iv. Wavy
    - v. Other
  - II. Prograding:
    - i. Oblique
    - ii. Sigmoid
    - iii. Complex Sigmoid Oblique
    - iv. Shingled
    - v. Hummocky Clinoforms
    - vi. Other
  - III. Mounded or Draped:
    - i. Erosional
    - ii. Intrusional:
      1. Shale
      2. Salt



3. Volcanics
4. Other

iii. Siliciclastic Mounds:
1. Eolian
2. Alluvial Fans / Fan Deltas
3. Contourites

iv. Carbonate Mounds:
1. Bioherms
2. Reef

v. Drape:
1. Pelagic Sedimentation
2. Differential Compaction

vi. Mass Debris Flows (Wasting):
1. Hummocky
2. Chaotic
3. Contorted or Disrupted
4. Other

vii. Onlap and Fill:
1. Basin Margin:
A. Continental Shelf
B. Slope Rise

viii. Topographic Highs:
A. Channels
B. Erosional
C. Aggradational

1. Isolated Basins:
A. Rim Syncline
2. Other

J. **Measured Section Correlation**
K. **Chronostratigraphic Reconstruction**

This page is at: http://www.walden3d.com/Abbott/indexing.html

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