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Southern South America Petroleum Provinces – Present and Future [1]

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Abstract

Forty-two sedimentary basins, ranging from Intraplate non-orogenic type to Plate margin with orogeny, are found in Meridional South America. Only seven of these basins produce commercial oil and gas, six of them are in the foreland-folded trend, that is the "Sub-Andean Belt" and one intracratonic, located in the Patagonian platform.

In most of these basins commercial production began in the early part of the century. Since then, exploration and development work has been mostly concentrated in those areas with established productive plays, postponing exploration efforts in the rest of the region.

Regional surveys have detected potential petroleum systems in more than one third of the non-producing basins, moreover, in those with existing production there are still under-explored frontier areas waiting to be tested by the drill.

In this context we can define three types of areas with exploration potential: 1) basins that are yet to be explored by the drill, 2) non-productive basins insufficiently explored, and 3) plays in producing basins that have not yet been tested.

It is a fact that new ideas and technologies supplemented by integrated basin studies are the key that will open up new exploration frontiers. The global geological vision, where the knowledge of analogies, backed by technological advances and new market demands, broadens and stimulates the exploring mind, aided by advances in technology and new market demands, encouraging the attempt to carry out further exploration work in these frontier areas.

Giant fields continue to be discovered in these relegated provinces such as the intracratonic rifts, fold belts and subtle stratigraphic traps. This same concept can be applied to the exploration challenge of the virtually untested South Atlantic margin.

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General

Meridional South America covers an area of 8.6 MM km^2 that includes Argentina, Bolivia, Brazil, Chile, Perú and Uruguay, of which the only countries with producing basins are Argentina, Bolivia and Chile, with a total of seven basins and accumulated reserves of 10,000 MM BBO and 36 T CFG.

Geologic setting

This region contains a central shield ("Brazilian Shield") bounded by the terranes welded later on its occidental border. Of the accreted terranes, the most salient are the Central Pampean Ranges, Arequipa, Pre-Cordillera, Chilenia and Patagonia Andes Orogenic Belt (the backbone of América) with an average height of 3,200 mts and maximum of over 7,000 mts

The massifs and ranges are surrounded by extensive plains such as the Chaco, the Pampas Grasslands and the Patagonian Plateau.

Southern South America was a part of the occidental sector of the Gondwana until the Neocomian when it separated with the formation of the South Atlantic Ocean, a like occurrence affecting Australia, India and Antarctica.

Furthermore, in the terranes accreted from Proterozoic to Cambro-Ordovician time, tectonic events occurred, which led to the formation of Intracratonic and Pericratonic basins infilled by marine and continental sequences ranging from Devonian to Cenozoic age.

Since Early Mesozoic, before the definitive separation of the American-African Plate brought about the formation of an extensive system of Rift and Sag (Post-Rift) basins in a passive type margin. The west active Pacific margin gave place to the formation of a tren of Foreland basins west bounded by a magmatic arc, while the rising Andean Orogen built a chain of Intra-arc and Fore-arc basins.

With the Laramic orogeny the rise of the Andean Batholith resulted from the active Pacific subduction. During theTertiary, successive Andean movements during the Tertiary built the orogenic fold-belt in the oriental sector, with the formation of a back-arc Sub-Andean Basins system. system of foreland, subandean basins.

It is in these basins where was concentrated the greatest exploratory activity since the beginning of the XX^{th} century, and from whence has come the production of oil and gas.

Basins Assessments

In this region are found forty-two sedimentary basins in systems that vary from intracratonic to foreland, covering a gross area of 7.5 MM km^2. Of these, though only seven actually produce commercial oil and gas, more than twenty have proven and/or hypothetical petroleum systems.

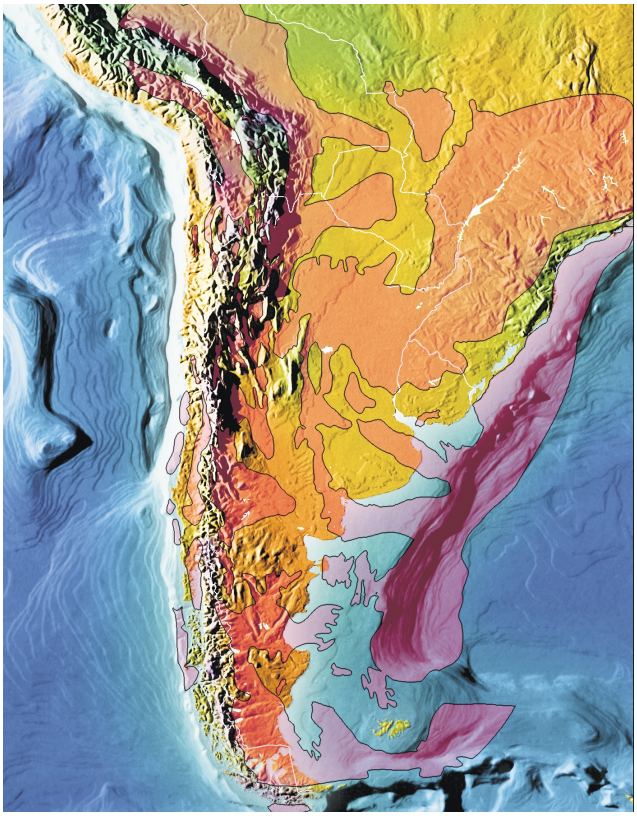

Figure 1 – Southern South America Relief map. In purple are the sedimentary basins, from east to west, Atlantic Rift, Intracratonic and Foreland Basins, west bounded by the Andes.

Continuing west, in Chile, West Bolivia and Peru are the Intra-arc and Forearc Basins.

No masked zones are positive areas; most of them related with the continental basement areas such the Plata – Riveira Craton, Guapare – Borbrena Shield (real continental). In the centre of the Map are the Pampean and Transpampean Ranges and Puna Plateau (Precambrian). To the south is the North Patagonia Massif (Somuncura Massif). Further south is the uplifted Deseado Massif. More details please address to figures 2, 3, 4, and 5.

PRODUCING BASINS

STA. CRUZ BASIN, *BOLIVIA*
TARIJA BASIN, *SOUTH BOLIVIA-NORTHWEST ARGENTINA*
ORAN-CHACO BASIN, *NORTHWEST ARGENTINA*
CACHEUTA (CUYO) BASIN, *ARGENTINA*
NEUQUEN BASIN, *ARGENTINA*
SAN JORGE, *ARGENTINA*
AUSTRAL- MAGALLANES BASIN, *ARGENTINA-CHILE*

Of the six countries included in the region described, Argentina, Bolivia and Chile are the only ones with commercial production of hydrocarbons. Of the seven producing basins Argentina shares the Northwestern basin with Bolivia and the Austral (Magallanes) with Chile.

Oil production is at present balanced at approximately 482 M BOPD, while gas is around 1.12 B CFGPD.

The remaining productive basins lie in Argentina, which, thanks to its strategic geographic position that favours the export and exchange of hydrocarbons, has become an “oil” country.

In the numerous basins with active petroleum systems, covering 551 M km^2, only 20% of the area can be considered mature; 30% is moderately mature and 50% immature (frontier areas).

Reserves

Total proven and probable reserves exceed 35,000 MM Bls. and 52 T CF. However, even in the producing centres it is presumed that as much as 25% of the available oil has still to be discovered, due to the fact that development and production efforts have been concentrated in shallow or readily accessible areas.

In the 42 basins in the described region in Argentina lie 36 sedimentary basins of proven or potential economic interest, covering an area of more than 2,792 M Km^2 (689 MM Acres).

From 1907 to July 1991, over 30,868 wells were drilled of which about 10,018 were in production in Dec. 1998, distributed in five basins; in total 463 commercial oil and gas fields were discovered, of which 284 are still producing. This exploratory activity gave as a result, a cumulative discovery of 10,269 MM Bbls oil and 36.34 T Cft of gas.

Basins Setting and Hydrocarbon Assessments

Basins Classification

The basins in South Bolivia, Argentina, Chile, Southern Brazil and Uruguay, are grouped in the following basin types:

Table 1 – Basins Classification

Intraplate Basins, non-orogenic setting, and Intracratonic basins.
- Rift basins (rift-bounded grabens or "pull-apart")
- Passive Continental margins (divergent Atlantic Margin type)

Plate Margin Basins, related to compressional orogeny, (active convergent plate-margin settings)
- Basins related to Andean-type tectonic (subduction"A)
  - a. Foreland
  - b. Intermontane basins
- Basins related to subduction (subduction "B")
  - a. Forearc basins
  - b. Intra-arc basins

Intracratonic Basins

The non-orogenic or Interplate settings include two principal classes: the Intracratonic basins, on continental crust, and the "pull-apart" basins developed at any stage between incipient rifting within the craton on wholly continental crust, and passive Atlantic continental margins at the transition between oceanic and continental crust. (Chaco-Paraná, Pampas and Central Patagonian basins are in this group).

These basins, located within the stable Brazilian Shield, underlain by continental crust, have a very gentle subsidence, low sedimentation rates, and low heat flow that imply a long time for maturation of the source beds. During times when circulation in epeiric seas on the craton was restricted by fold belts that surrounded the craton, a warm climate would favour the accumulation and preservation of organic mater, specially under lowest sedimentation rate. Long periods of transgression developed widespreading source rocks and reservoirs that overlie extended Cratonic unconformities, such as the Upper Devonian and Carboniferous.

Since Late Cambrian-Silurian times thermal subsidence centres developed within the western Cratonic mass of the Gondwana Supercontinent commonly known as the "Guapore Shields, Pampean Ranges, Plata-Ribeira, Brazilian-Shield, and North Patagonia Somuncura Massif". Sedimentary fill is made up of Early Paleozoic, Siluro-Devonian, Late Paleozoic, Triassic, Jurassic and Cretaceous sequences. Cainozoic sediments are thin and occur as remnants in a few scattered localities.

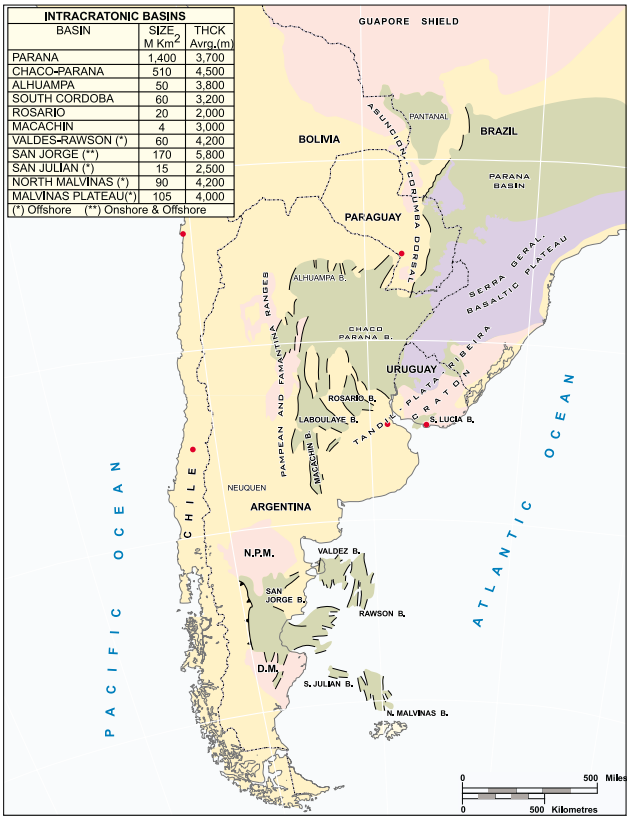

Figure 2 – Intratonic basins.
The formation of these basins is related with thermal subsiding centres of the westernmost Gondwana cratonic and pseudocratonic attacched terranes. Chaco-Parana and Pampas Basins resulted then from polihistoric tectonic and sedimentary events. Central Patagonia Plataform Rifts were incised from Latermost Paleozoic and mainly Mesozoic time onto successive acidic extrusive volcanics in a "Basins and Ranges " type region. On the Atlantic shelf on similar events sculpted same aborted rift basins.

The most salient centres are: Chaco-Parana basin, and Central Patagonian Platform.

Rift Basins
Fault bounded rift basins and half grabens in passive margins are two end-members of a continuum that represents the evolution of the other type of mid-plate or intraplate basins. They develop in intracratonic and pericratonic positions, on continental crust areas, which in the late end stages become transitional between continental and oceanic crust.

Rifting is the first stage in the continuum, and each successive stage preserves a record of preceding stages. This entire class of basins, therefore, has a paleotectonic rift-basin or rift-bounded graben, or "pull-apart" basin as the setting for some, or all, of its source rocks.

The evolution from earliest or incipient rifting to a fully developed passive margin may be divided into four stages which merge into each other, as follows:

Incipient and/or Aborted Rift Systems
These are rifts which did not yet, or never will, open to develop an oceanic crust. They include the Central Pampas basins, and the Central Patagonia Platform Rifts, as the Valdes-Rawson, San Julian and North Malvinas (North Falklands-). In this tectonic setting source, reservoir and seal rocks have been deposited; overburden would have matured these systems, where exploration is still scarce.

Rifts which are Ocean-Facing Failed Arms of Triple Junctions
In this stage, the rift system has opened so that an early ocean begins to develop, as two arms of a triple junction begin to spread apart. The third or failed arm does not spread, but strikes into the continent, facing the

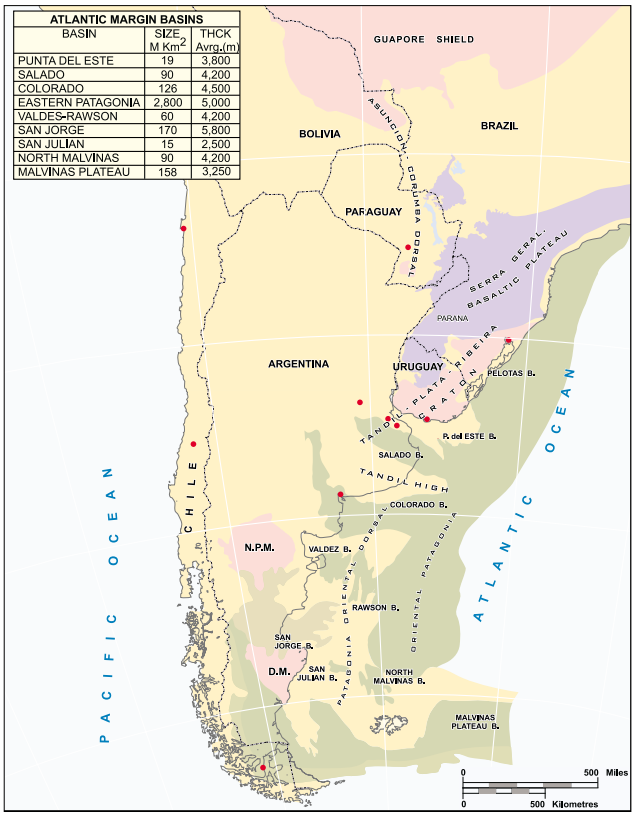

Figure 3 – Atlantic Margin Basins.
Among the continental shelf basins sited as described in Fig.2, the Salado and Colorado are a triple junction basins, product of the Gondwana brick up, and filled mostly by Middle Mesozoic continental, synrift sequences. The real Atlantic Type Basins are located on the Slope-Rise sector, product of the proto-Atlantic Intercratonic Rift section. Depositional sequences piled as product of late rift and then sag sequences.

newly developing ocean. Rivers flow down the rifted depression of the failed arm, develop deltas that prograde into the future ocean, and the failed arm continues to be a locus of subsidence and sedimentation. Source beds formed during the early stage become buried and continue to evolve toward maturity. The Salado and Colorado basins are bounded by faulted crystalline and metamorphic basement, and run perpendicular to the continental margin.

They owe their origin to the tensional tectonism that originated diverging passive margins during the early stages of the separation of Africa from South America, in successive tectonic phases from Early Cretaceous to Present time.

Young Passive Margins

Closely associated with Failed Arms, are young Passive Margins or “pull-apart” basins, i.e. rifts which have already begun to spread apart and developed into an oceanic pseudo-crust formation, within the rapid thermal subsidence. Source continental beds (alluvial and lacustrine synrift facies) deposited during the early rifting stage have be buried and possible matured by the sediments load during the continental margin formation which begins with a marginal sag stage. Shallow marine waters circulation is still quite restricted, anoxia and organic productivity prevail, and new source beds may have developed within the sedimentary sequence deposited during this second stage.

The widespread Late Jurassic and Early Cretaceous /(Tithonian-Barrenian) black shales of the Southernmost South Atlantic and Weddel seas region between Madagascar, Australia, and Antarctica, were probably deposited in this type of setting. These sequences, later extended beyond the R. Grande and Walvis Ridge between Brazil and Equatorial Africa, were deposited in the same tectonic setting and yield commercial oil in the deep Campos and Congo basins.

With the exception of M.Ewing Massif, in East Malvinas Plateau (JOIDES boreholes) and offshore Namibia

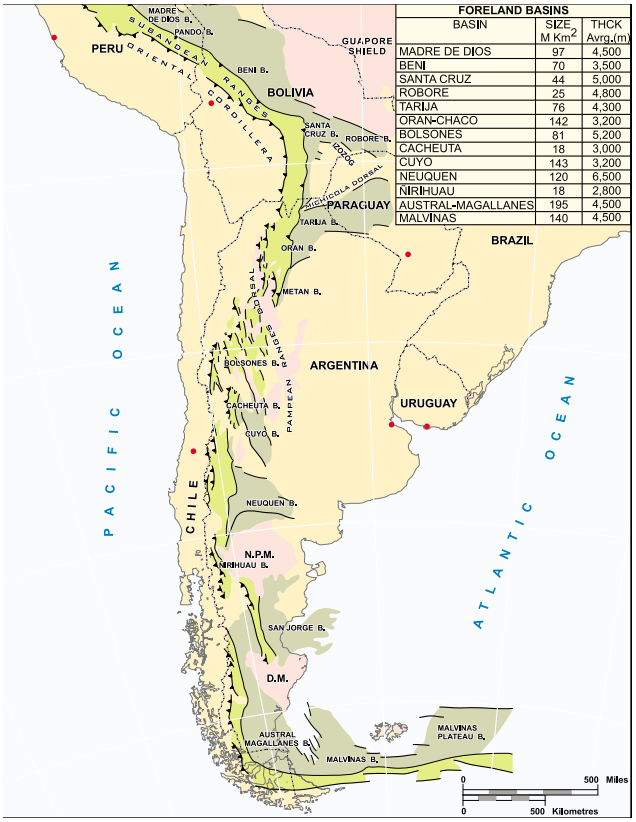

Figure 4 – Foreland Basins.
The basins are the result of the Pacific "Subduction B" reactivation, flexured Protorozoic and Precambrian platform building the western Foreland Belt. The west limit is an active magmatic arc, which restricted open marine circulation. A low oxygen depositional marine centre created, where most organic rich sequences where concentrated. The Late Cretaceous tectonic movements uplifted the "Andean Batholith" building the Sub Andean fold and faulted belt.

(Kuddu borehole) oil shows, no further shows has been reported from Early Cretaceous sequences. However, in Argentina C. Slope, piston cores from outcrops of the same age, reported samples with organic rich shales. Seismic data shows also horizons onlapping as marine transgressive units onto the sag sequences.

Beneath the continental slope and rise, these early, shallow marine and coastal sequence lie on a transitional crust. Seismic data shows that these highstand events onlap the basal rift units and also grade into the outer sectors of the Salado and Colorado basins. These little known young passive margin depocenters are still little explored. However petroleum systems await discovery in the area under study.

Atlantic Type Margins

After the separation of Africa and South America, the Atlantic margin synrift continental facies, were filled by interior sag and then marginal sag in the interior of the "Proto -Atlantic margin".

As the continental plates spread continued, the oceanic crust widened, developing true "Atlantic-type" passive continental margins. A thick prism of clastic sediments progrades over the "post-rift unconformity". Clastic sedimentation it is not inhibited and supply of sediments is high; no carbonate platforms seem to be developed in this region. In any case, the principal source beds for hydrocarbons may be in the underlying rift-bounded grabens, or in the pre-break-up rifted stage of the new ocean.

These Atlantic basins are, from north to south, from the Rio Grande Rise: Pelotas, East bound of Salado-Pta. del Este and Colorado, East bound of Rawson, Eastern Patagonia Continental Slope & Rise, and eastern arm of North Malvinas basins.

Source beds developed during the passive margin sag stage, generated a sedimentary prism over 5,000 m. thick are likely to be localized in depocentres, as conditions favoured a restricted rather than widespread environment. Although organic productivity along the margins may have been high, oxygen minimum layers

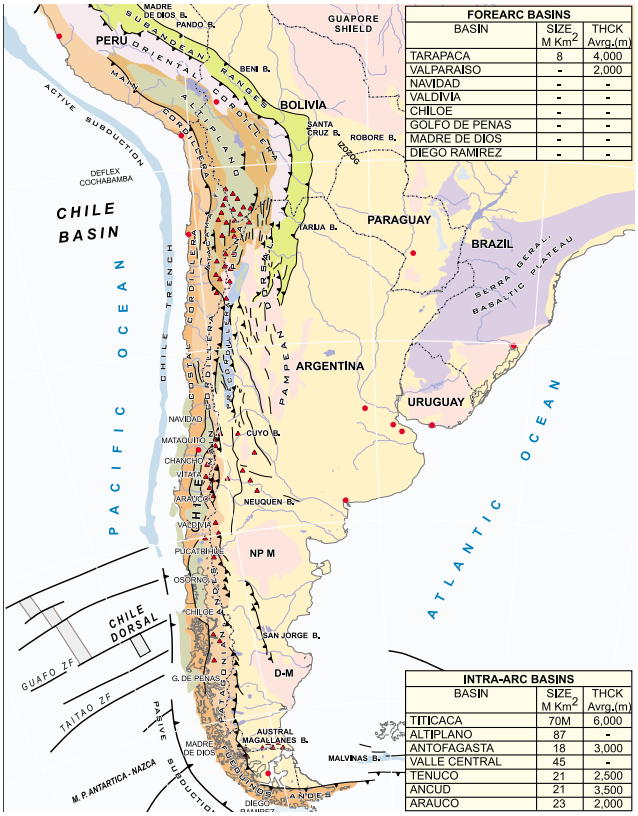

Figure 5 – Intra-arc and Fore-arc basins are inserted on the raised Andes. Mesozoic sequences alternating with igneous rocks remain as relict. During the Tertiary Andean tectonic pulses, Tertiary shallow marine and continental sequences fillled these depressions.

may have existed on the continental slopes and rise, especially during times of low sedimentation (high sea level stands). However, the geothermal gradients of fully developed passive margins tend to be low, as heat flow decreases away from the spreading centre. Thus, basins of this type may have two different paleothermal gradients: an older, higher gradient when the basin was close to the spreading centre, and a younger, lower gradient during the sedimentary prism deposition. Hence maturation will have resulted from deep burial by the rapidly accumulating sediments on the subsiding margin.

The Atlantic Shelf basins are similar to their onshore counterparts, as they are products of the same evolutionary processes. Thus it is that the seismic surveys and geophysics in general (gravity, magnetism), offer a clear view of their structural and sedimentary architecture.

The paleogeographical reconstructions, backed by paleontological, climactic and sedimentary information makes it possible to establish quite accurate analogies. A classical example is given by the San Jorge and Austral basins where the known onshore data is identical to the offshore.

Therefore, emphasising the assessments of the Petroleum Systems of the Patagonian Platform, it is not difficult to establish high expectations for this province.

The global tectonics and reconstructions of preterit continents establish very precise connections.

Unfortunately, in the offshore, the paucity of geophysical and drilling data generates uncertainties and ambiguities. Therefore, in spite of this, in the areas where exploration in greater detail has been perseveringly continued, as in the case offshore Tierra del Fuego, very satisfactory results have been obtained.

Plate Margin Basins

Plate margin basins related to compressional orogeny are bounded by the megasutures that resulted from the

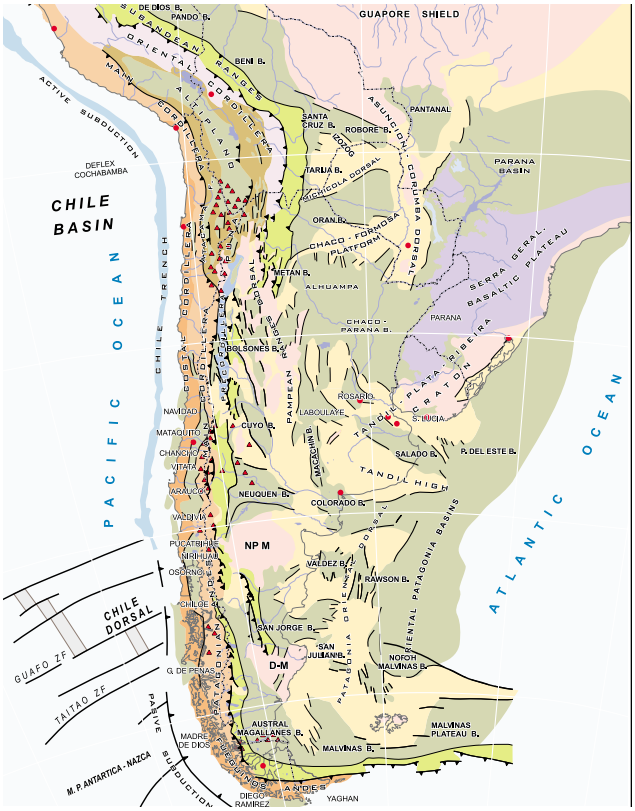

Figure 6 – This map shows the main tectonic features, basins (green), basement outcrops and raised Massif (purple), the Sub Andean Fold Belt (light green), Pre Cordillera ( ), Puna Plateau (brown), Andean Belt ( ), Quaternary active and inactive volcanoes (red triangles), Intra arc and Forearc basins ( ) and Chile trench, related with the active subduction.

collision of Pacific and S. America convergent plates. The collision took place between the west continental plate margin, built by successive accreted terranes in Proterozoic times, and later, from Early Paleozoic, the Panthalassian convergent oceanic (active) plate. These basins include two principal types: basins related to Andean-type or “A” subduction, basins related to Benioff-type or “B” subduction.

Foreland basins

These basinal complexes began on a flexured thermally subsiding pericratonic platform, faulted in east-west trending rift systems. In the early stages, sedimentation was predominantly continental. This is the case of the Northern Bolivia (Pando basin) east Sta. Cruz (Robore basin), S. Bolivia and northwest Argentina (Tarija basin). In the foredeep thick accumulations of sediments developed on continental crust between the mobile magmatic arc and the central craton. In their early stages, the sediments in foredeeps formed miogeoclines in marginal depressions inside an incipient compressional belt. The early foredeep stage accompanies the beginning of compressional folding and subduction of oceanic crust.

The basins that lie along the “East South American Andean Backbone” are bounded by a megasuture “A” in the eastern limit of the Andean Fold Belt, locally called “Sub Andean Basins”.

Restricted marine circulation favoured the formation of source beds. Heat flow was low to average, later stages involved rapid sedimentation in the foredeep, such as flysch, and later molasse - from the adjacent mobile belt, so that organic matter maturation achieved in the foredeep or miogeoclinal no before the Early Tertiary. In these basins, source rocks, since the early transgressive shales, are among the most prolific hydrocarbon producers in the continent. The basins discused in this paper are as follow:

Foreland Platform Incise Rifts

Late Paleozoic depocenters were formed also and filled with marine and continental sediments. As in the

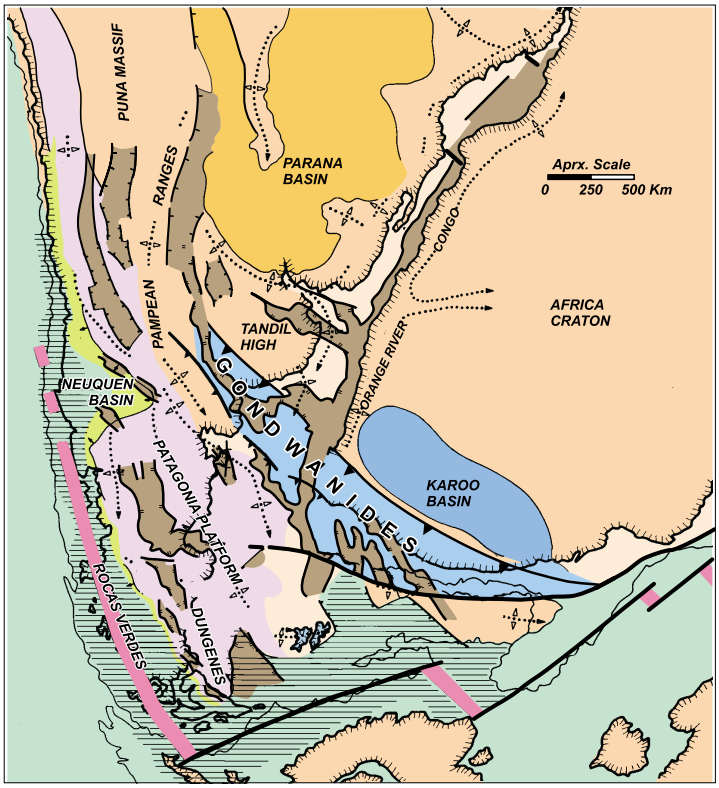

Figure 7 – Early Gondwana Break Up and formation of Rift basins.

Paleogeographic reconstruction at the time of Intercratonic Rift inception. Gondwanides is the Ventania-Cape Folded Belt, form as a result of Patagonia terrane docking.

Since Late Permian, throughout Triassic-Jurassic, during acidic extrusive episodes a "Basin and Ranges" type region extends on the western portion of the continent. Due to trans-tensional forces transform segments build "en chelon rifts". With exception of the Central Rift non of the Patagonia Platform rifts reached the oceanic crust stage, this is the first oceanic incursion in the region about 145 Ma. To the South Weddel sea is created, triggering the spread between the Afro-America Plate with respect to the Antarctica-Australia and India Plates. To the Southwest the "Rocas Verdes Basin Spreading Centre", is inserted, further north is the active subduction zone which favoured the formation the "Neuquen Foreland Depocenter".

"Bolsones", Triassic and Jurassic sequences were superimposed on them during Triassic and Jurassic times, associated with volcanic acidic and pyroclastic episodes.

Up to the present, units with oil prone sequences have been tested only in West Cuyo Cacheuta Sub-basin and Eastern Neuquén basin, both with commercial hydrocarbons production.

In Cuyo and Neuquén these rifted depocenters have yielded oil and gas. With the exception of the Cuyo, Cacheuta subbasin, the "Intermontane Bolsones" are virtually unexplored.

In Southern Chile (Tierra del Fuego Island), Late Triassic -Jurassic grabens, filled mainly with continental sequences alternating with acidic volcanics, yield commercial oil production.

Many tectonic episodes took place in the western part of the continent, which are responsible for lengthy deposition and non-deposition periods. In fact, the most complete events of the geologic evolution of this part of the continent are mainly recorded in this Subandean belt.

In fact, here are present the most varied combination and recurrence of marine sedimentary high and low stand environments throughout the Middle-Late Mesozoic and Cainozoic, giving place to many petroleum habitats throughout most of the stratigraphic column, particularly in Neuquén, West San Jorge and Austral-Malvinas basins.

Intermontane Basins

A final stage in the evolution of foreland basins is their breakup into partially inverted post-orogenic intermontane basins such as the Central West Cuyo-Bolsones and Calingasta basins. Source beds for these basins were deposited during the earlier foreland stage, and matured at a late geologic time (Pliocene).

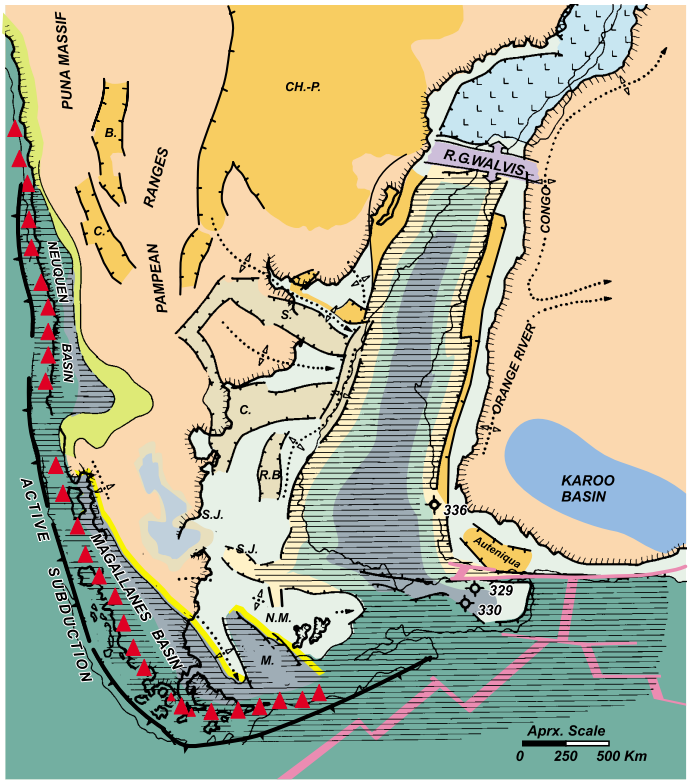

Figure 8 – Mid Cretaceous Sag-Drift Stage (South Atlantic Ocean Birth).

Deltas, alluvial plains, coastal lakes mantle the quasi oceanic crust, and shallow marine sequences where rich mix organic source rock is deposited under anaerobic conditions. In the central. Pre-Atlantic through, extremely organic rich petroleum system could lie beneath the continental rise and slope, as well as in the outer failed arms graben. In the western continent an active subduction is now stablished. The foreland basins almost are coalescing in the foredeep trend, where low circulation marine waters are the recipient of organic rich colloidal and masseral organic mater under a strictly oxygen deficient layer. These fine grained sequences and basin rim clastics will be the richest proven and active petroleum system in this side of the continent.

Basins related to "B" subduction

These basins are to be considered as a class related to the compressional megasuture associated with the "B" subduction zone, in which oceanic crust is subducted under continental crust. Their tectonic settings are **Intra-arc**, and **Forearc** basins.

The **Intra-arc basins** were formed behind magmatic arcs. This is a difficult type in which to define source rock setting. Organic material may be low or high, depending on geographic conditions. Dilution by rapid sedimentation may be high. Heat flow is generally high so maturation can take place under relatively shallow burial. Such basins, which have source sequences deposited in this paleotectonic setting, are localized in Central and southern Chile.

Forearc Basins are settings between the magmatic arc and the associated "Chile Trench" as in the case of Antofagasta basin. Heat flow is lower. Distribution of organic matter depends on local conditions. Sedimentation rates are high and may be excessive. This group of compressional-type basins is also associated with the collision of two plates where strike-slip faulting could be present. Good source rocks can develope in such basins because they are tectonically isolated blocks. Heat flow varies in such basins, in accordance with the magmatic pulses; if organic material accumulates, it can be preserved, matured or destroyed by rapid burial.

The Future

Multiple or composite (of different ages) to specific petroleum systems are identifiable in most all of the basins. Oil source rocks and reservoirs run the gamut from the Lower Middle Paleozoic to the Middle Tertiary.

Two active systems predominate in the region: (1.) The Devonian, in the Sub-Andean of Bolivia and northwest Argentina, and the intracratonic Chaco-Paraná basin; and (2.) The Oxfordian-Neocomian is, perhaps, the

most extended and richest petroleum system (proven and hypothetical) found throughout all the foreland basinal system, intracratonic San Jorge Basin, Patagonian Platform rifts and passive Atlantic basins.

To a great extent, these basins already have active producing centres, however, in spite of the “apparent” maturity, additional petroliferous trends have been added that form new active petroleum provinces.

1. The basins with the highest cumulative production, San Jorge, Cuyo and Neuquén,occupy only 35% of the inland basin area. In addition, 80% of the exploratory wells in the country were drilled here, an average of one well per every 21.7 M Ha (43.5 M acres).

2. The average in the other non-producing basins is one well each 492 M Ha. (246 M acres).

These figures give a slight idea of the scope of oil exploration opportunities in the region.

Deregulation of the gas market and the increasing demand from neighbouring countries has brought about a remarkable change in the exploration effort, with the object of meeting the increasing demand for export to Chile, southern Brazil and Uruguay. Actually, the gas pipe-line network has been expanded, not only to take care of local distribution but also to supply gas to Chile and, in the near future, to Uruguay and Brazil (Porto Alegre and Sao Paulo). “Surprisingly”, since 1985 and particularly the last five years, important gas reserves have been discovered in apparently mature trends as also unexpected new intervals (¿!).

The fact is that, for instance Neuquén has become a critical oil and gas centre, with two pipe-lines (one gas and one oil) to Chile. This is followed by the Tierra del Fuego pipeline that delivers gas to the Methanol plant in Southern Chile, and by the northern line connecting with the Pacific over the Altiplano. The lines to Uruguay and Southern Brazil are under construction.

In fact, deep drilling in matured areas, (e.g. Bolivian Subandean and in Argentina Tarija and San Jorge basins), has significantly enhanced the existing known reserves. As far as exploration goes, the fact is that over the last 10 years, pools with over 250 MM BO and .600 BCFG each have been discovered in the Tarija, Neuquén, San Jorge, and Magallanes Basins, with new possible pools of 30MM barrels, but, there are also some, and not too few, of 200 and 300 MM.

This situation generates a change in the strategy to be applied in acquisitions and particularly in respect of the exploration for new reserves. Moreover the hitherto considered “frontier” areas, are now closer to the markets and therefore the commercial risks are substantially reduced.

Thus it is that projections for the future leads to the consideration that areas with commercial production and apparently mature (not more than 25 % of their prospectable territory) are once again enticing exploration targets, in which new information and technology are indispensable to enhance the geological experience and minimize risks. In this connection, there are conclusive examples in Neuquén, Northwest and Austral basins.

This vast and little known region, so near to the emerging Southern Cone markets, is an exploratory challenge well worth consideration.

The Atlantic Passive Margin basins are similar to their onshore counterparts as they are products of the same evolutionary processes. Thus it is that the seismic surveys and geophysics in general (gravity, magnetism), offer a clear view of their structural and sedimentary architecture.

The paleogeographical reconstructions, backed by paleontological, climactic and sedimentary information make it possible to establish quite accurate analogies. A classical example is given by the San Jorge and Austral basins where the known onshore data is identical to the offshore.

Therefore, emphasizing the assessments of the Petroleum Systems of the Patagonian Platform, it is not difficult to establish high expectations for this province. It would, therefore, be wise to be alert to all the possible opportunities, particularly considering the singularly accessible characteristics of the territory under analysis.

Within the boundaries of the areas actually in production, there are zones that are practically untouched and therefore unknown, due to the very short-sighted and simplistic exploration policies applied hitherto. This, then, is another possibility open to explorers, particularly when they have a real, accurate picture of the geological assessment of the basins.

A good deal of databases, studies, geologic surveys have been performed, both by the State owned oil enterprises, Geologic Surveys and private companies. However, Geochemical data is scarce, and does not enable an accurate definition and delineation of the real hydrocarbons generating potential in this extensive and environmentally favourable territory

This situation, offers the new century challenge, to be met with new technology that will help to resolve the many unsolved problems that have hampered and delayed the opening of new exploration frontiers, even in the apparently matured fields or with production from shallow intervals.

Gas, as a matter of fact, which during the last four decades was considered non-profitable, and thus avoided, or disregarded, is now a deregulated market and therefore has become a coveted asset. A new hydrocarbons geography has emerged, in terms of fluids production, distribution and marketing, that forces a reconsideration of concepts, some of them forgotten, held, in the past to be impractical and / or uneconomic. In fact, over the last few years, thanks to new technology, and, as pointed out above, new and expanded markets, treasure has been discovered in new and old petroleum provinces.

I trust that these concepts will help to confirm the exploration intentions of those companies that are on the look-out for challenging opportunities in areas where the outcome of the venture, operating conditions and, above all, market and political climate are in every way favourable.

The question that arises now, is: Do giant fields really exist or not? The answer is very definitively affirmative. WARNING!! The hunter that goes out into the field obsessed by the burning ambition of bagging an elephant, will be running the risk of missing excellent opportunities of securing beautiful elands.

A cursory examination of the exploration statistics, will show that the size of the majority of the fields discovered, is in the order of 30MM barrels, but, there also some, and not too few, of 200 and 300 MM barrels oil equivalent.

Deep drilling in matured areas, (e.g. Bolivian and Argentina Subandean and San Jorge basins), has significantly enhanced the existing known reserves. As far as exploration goes, the fact is that over the last 10 years, average pools with over 250 MM Bls oil and 2 T CF gas each have been discovered in the Tarija, Neuquén, San Jorge, and Magallanes Basins.